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No. 1.

PARASITIC CONTROL OF SHEEP MAGGOT-FLIES.

NOTES ON CURRENT WORK.

DAVID MILLER, Entomologist, Biological Laboratory, Wellington.

Issue of this *Journal* for June, 1921, and for the same month following year, accounts were given of the species of sheep flies and their habits in New Zealand. It was then pointed out that the hairy blow-fly (*Pollenia stygia*), the European greenbottle (*Serica sericata*), and the Australian greenbottle (*Pycnosoma rufifacies*) were the three species responsible in the first instance for wool-blowing, and that other secondary species bred in the wool rendered putrescent by the attacks of the three former species.

Now maggot-flies are becoming more apparent in their attacks on sheep, and, though they attack sheep in any part of the Dominion, they are more noticeable for their annual persistency and extent of damage in the districts of the South Island northwards of and including North Canterbury. One of the most important phases in the blow-fly problem is the increasing amount of wool that is blown.

Control of maggot-flies

by parasitic insects

is the latter. Several

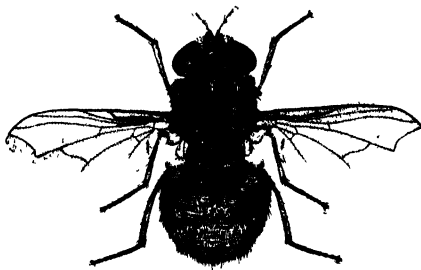
species are known both in New Zealand and Europe,

and in New Zealand a natural check to blow-fly development is the use of insecticides. The most important of the known parasites are the blow-fly parasites, *Nasonia brevicornis*, *Alysia manducator*, *Aphaceta*, *Syntomosphyrum glossinae*, and *Tachinaephagus australiensis*. These parasites all belong to the order Hymenoptera, which includes bees, wasps, and ants.

22 consignments of *M. brevicornis* were received from Mr. J. G. Grogan, late Government Entomologist, Sydney, N.S.W., and 1000 were liberated.* Some time earlier Mr. C. G. Teschemaker, "Blenheim," also secured this species from Australia and introduced it on his station. But up to the present this parasite

* *Journal*, April, 1922.

has had no effect upon the blow-flies. *M. brevicornis* lays its eggs in the blow-fly pupæ, and it is very probable that a high proportion of parasitism under natural conditions cannot be attained, since most of the blow-fly maggots, prior to pupating, burrow underground, where



[FIG. 1. GOLDEN-HAIRED BLOW-FLY (*POLLENIA STYGIA*) $\times 2\frac{1}{2}$.



FIG. 2. MAGGOT OF *POLLENIA STYGIA*. $\times 3$.



FIG. 3. PUPARIUM OF *P. STYGIA*. $\times 3$.

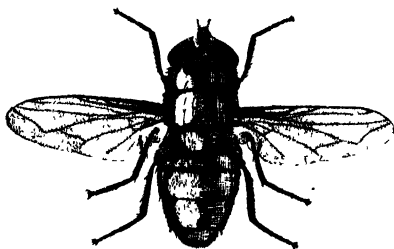


FIG. 4. EUROPEAN GREENBOTTLÉ (*LUCILIA SERICATA*). $3\frac{1}{2}$.

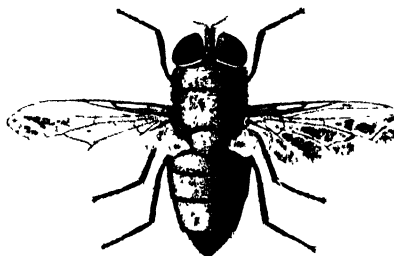


FIG. 5. AUSTRALIAN GREENBOTTLÉ (*PYCNOSOMA RUFIFACIES*) $\times 3$.



FIG. 6. MAGGOT OF *P. RUFIFACIES* $\times 3$.

it would be difficult for the parasite to follow. Only a small proportion of fly pupæ lying in more or less exposed situations would be subject to its attack.

On this assumption it was decided to secure another species of parasite and one that would lay its eggs in the maggots before the latter



FIG. 7 DEAD SHEEP ON A STATION
cient maggots breed on such carcasses to infest country for many miles
ggot-flies.



FIG. 8. SHOWING MAGGOTS LEAVING SHEEP-CARCASE TO
PUPATE IN GROUND.

sought shelter for pupation. Of the aforementioned species there are three that have this habit—*A. manducator*, *A. cephalotes*, and *T. australiensis*. The Imperial Bureau of Entomology, London, has been active in this matter, and we have recently received from Dr. G. A. K. Marshall, the Director, two consignments of blow-fly pupæ, from which about ninety adults of *A. manducator* have been reared to date of writing (New Year). These are being worked with now in the Biological Laboratory, where they are put into cages with maggots of four species of blow-flies (*P. stygia*, *L. sericata*, *Calliphora erythrocephala*, and *C. hortona*). The female parasite has been observed actively laying eggs in the maggots, but, so far, from none of the resultant pupæ have parasites again emerged. It is too early, however, to expect definite results.

Through the generous interest of Dr. G. H. Hardy, of Brisbane University, four blow-fly pupæ have been secured. Dr. Hardy states that he observed the four maggots before transferring to the pupal stage to be attacked by *Tachinaephagus*, which, however, has not yet emerged from the pupæ.

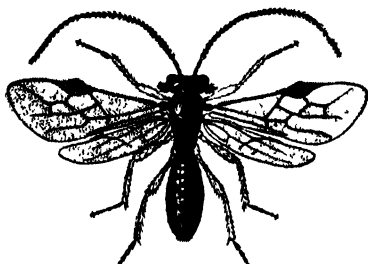


FIG. 9. MALE *ALYSIA MANDUCATOR*
(MAGNIFIED).



FIG. 10. FEMALE *ALYSIA MANDUCATOR* LAYING
EGG IN MAGGOT (MAGNIFIED). [After Altson]

It is intended at present to concentrate on *A. manducator* before liberating any other parasites. The life-history of this insect has been studied by A. M. Altson, and the results published in the Proceedings of the Zoological Society of London for 1920. *A. manducator* is shiny black and easily seen. According to Altson the female lays a single egg in each maggot, which latter, though frantic in its movements when first attacked, becomes temporarily paralysed while the parasite's egg is being placed in its body, owing to a poison injected through the attacker's ovipositor. Shortly after the egg is laid in the maggot the latter pupates; from the pupæ an adult parasite emerges in place of a blow-fly. Altson found that the time taken by *A. manducator* to develop from egg to adult varied considerably, but the mean average was fifty-two days.

In this maggot-fly work Mr. C. G. Teschemaker has been giving a great amount of active assistance in the field, by observation of experiments, and by supplying sheep from his flock whenever required, as well as in many other important associated matters.

WEEDS AND THEIR IDENTIFICATION.

(Continued.)

STRAWBERRY-RASPBERRY (*RUBUS ILLECEBROSUS*): A NEWLY REPORTED BLACKBERRY-LIKE PLANT.

ESMOND ATKINSON, Biological Laboratory, Wellington

SOME months ago specimens were received at this Laboratory from a farmer near Dargaville, North Auckland, of a plant which he said was spreading fast on his land and which he considered likely to prove a worse weed than blackberry. The specimens agree with the description of *Rubus illecebrosus*, a Japanese species grown in the United States—where it is considered troublesome if allowed to spread—and there known as “strawberry-raspberry.”

DESCRIPTION.

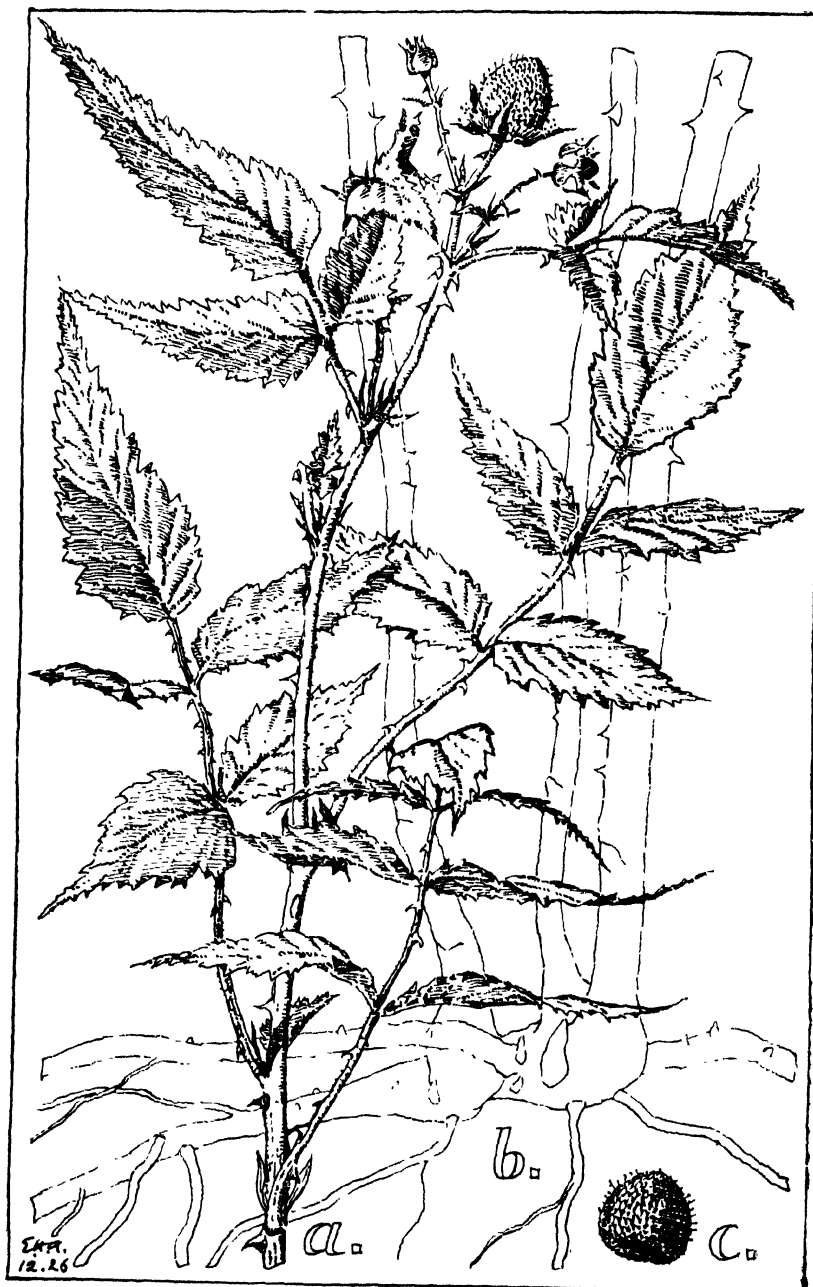
The accompanying illustration (*a*) shows something of the general appearance of a flowering branch of the plant with its raspberry-like fruits and its characteristic leaves. Towards the top of the stem there are often only three leaflets in each compound leaf, or those at the side may be undeveloped so that the whole leaf appears as a simple one. Farther down the stem five, seven, or more leaflets make up each compound leaf. The appearance of these at once separates the plant from any of the forms of blackberry, as they are pinnate—that is, like those of the sweetbrier- and not palmate with all the leaflets springing from one point. The leaflets are elegant in shape, with a long-drawn-out tip, strongly veined, and with their edges sharply and irregularly toothed. Most parts of the plant are covered with a very slight soft down.

Prickles are present both on the main stem and on the stalks of the leaves and flowers, but are not strongly developed. No fully opened flowers appear in the illustration (*a*), only buds and unripe fruits, the latter showing the long pointed sepals (the outermost part of the flowers). The drawing marked (*c*) shows how the fruit falls away when ripe, in the same way as does a raspberry. The fruit is said to be sour, but good for cooking. In New Zealand it is borne all the year round, although the plants carry a heavier crop in the summer months. The outline drawing (*b*) shows more or less diagrammatically the lower parts of the stems and the horizontal roots which radiate from the main plant, spreading widely at a short distance below the surface of the soil. Numerous small pointed projections will be seen scattered about on the roots. These are shoot-buds, and each is capable of developing into a new plant with its own root-system.

The plant when growing gives off a strong sickly smell, and it is stated that no stock will eat it.

DISTRIBUTION AND CONTROL

It is not known how the strawberry-raspberry originated in New Zealand, and it has not previously been recorded as an introduced plant in this country. It may have been imported as a garden-plant



STRAWBERRY-RASPBERRY (*RUBUS ILLECEBROSUS*).

(a) Flowering shoot; (b) outline of rooting-system; (c) fruit. All natural size.

[Drawing by Esmond Atkinson.]

and escaped from cultivation, but nothing certain is known. What is more important is that it is definitely established here and is capable of rapid spread--the account of the root-system shows its potentialities. It is also likely that birds eat the fruits and so carry the seeds. Some field notes made by Mr. A. W. Christie, Inspector of Stock, Dargaville, may be quoted here :—

The land on which this plant is growing is bush country, the bush having been felled for about seven years. The block of country is about 350 acres in extent, and the plant is growing in small bushes here and there all over the block in the same manner as blackberries grow, but if put together the plants would not cover many square yards.

The plant is shallow-rooted, and can be destroyed by fire. On some of the patches the landowner had heaped wood and made a fire, which killed the plants. The roots, however, travel a long way just under the surface of the ground, and shoot up outside the edge of where the fire has been. In my opinion it would be much easier to kill than blackberry, as the plants can be pulled up from the root by hand.

About six weeks after this was written Mr. Christie reported that the weed was showing signs of spreading again.

In the case of most well-known and long-established weeds it is easy enough to lay down definite rules for their control under many different conditions, but with a weed like strawberry-raspberry little more than suggestions can be given. These include burning and hand pulling, followed by a careful watch on the area outside that apparently occupied by the plant, also the use of sprays as for blackberry. Further, in spite of what has been said about stock not touching the plants, the possibilities of feeding off with goats in cases where it is covering large areas must be considered--though as regards blackberry this latter method is still more or less in the experimental stage.

The primary objects of this article are to call general attention to the weed by giving some idea of its appearance, and to ask for information from any one who may have been fighting it in some way evolved from his experience under particular circumstances while remaining unaware of the plant being a weed new to this country.

The writer wishes to thank the owner of the property where strawberry-raspberry has appeared for his promptness in sending specimens and notes; Mr. Christie, who has the weed under observation, for the valuable help he has already given; and Mr. W. R. B. Oliver, of the Dominion Museum, for assistance in identifying the plant.

Importation of Seeds into New South Wales—Regulations governing the importation of seeds into New South Wales, made under the provisions of the Agricultural Seeds Act of that State, were published for general information in the *New Zealand Gazette* of 9th December, 1926. The regulations deal mainly with noxious-weeds seeds, seed nomenclature, and seed impurities. The following treatment is prescribed concerning lucerne:—Lucerne-seed other than that grown in Australia shall, before being sold, be treated in the manner following. Not less than 5 per cent. of such seed shall be stained by immersion in an aqueous solution of saffranin made by the addition of not less than 1 ounce of saffranin to 7 gallons of water, and such stained seed shall thereafter be thoroughly mixed with the unstained portion of the seed; provided that such treatment shall not be necessary if such seed has been treated in accordance with any Proclamation in force for the time being under the Customs Act.

FOREST NOMENCLATURE.

WITH SPECIAL REFERENCE TO THE EUCALYPTS.

Paper read by J. H. SIMMONDS, Takanini, at the Annual Conference of the New Zealand Association of Nurserymen, Auckland, January, 1927.

IN all civilized countries trees as well as other plants have two sets of names. Those of the one set have been derived from the common or vernacular language of the people: they vary from country to country. Those of the other set have been deliberately given by learned men; they have been derived from Greek and Latin, or have been modelled in accordance with the usages of those classic languages: they are the same in all countries. The common or vernacular names are without descriptions of the plants to which they are attached. They are what in Latin would be called *nomina nuda*, or naked names: that is to say, they are names without the clothing of descriptive information about the plants. In contrast with this nakedness of the common names, each scientific botanical name carries with it an exact description of the plant or group of plants to which it is applied.

The familiar English word "oak" is commonly associated with a group of trees that bear acorns and produce hard and durable wood. It has a noble place in the history and poetry of the English people; but it does not carry with it a definite description of the trees it designates. With a plastic language and changing circumstances it may easily become detached from the acorn-bearers and attached to other genera. In Australia this has actually happened. There were no oaks in the indigenous forests of that country; but early bushmen, prompted by some fancied resemblance of the fruits to acorns, called *Casuarina* trees and *Grevillea* trees "oaks"; and the name has clung to those trees ever since. This shows that even the most dignified of vernacular names may be unstable in their attachments.

The generic botanical word for the acorn-bearing group of trees is *Quercus*. It has the same scope and meaning in all countries, and cannot anywhere be used as the name of another genus. The names of its numerous included species are similarly registered and fixed in application. A common name may wander about from one object to another. A botanical name must keep always to the same object, unless competently changed by the consent and authority of learned men. Without a uniform and constant nomenclature progress in any science would be impossible. Only the exact language of science can record discoveries and pass them on to another generation. Ignorant people sometimes rail against the so-called technicalities of the learned. If they knew a little more they would understand that without technical terms and records we should still be groping our way amongst the most common objects in nature.

Trade is dependent in a hundred ways upon science. This is more clearly realized and more fully admitted every year. Education demands that science and trade shall be in agreement. Discrepancy in nomenclature is inconsistent with such agreement. The trades dependent upon botanical science pressingly need reforms in this respect. The timber trade especially is infected with the vice of

calling numerous things by names that are not scientifically defined. It would be easy to multiply examples in support of this statement, but as space is limited one must here suffice.

The student learning botany at college is told that the genus *Cedrus* includes three and only three species. He learns that one species (*Cedrus deodara*) is indigenous to the Himalaya region in India; a second (*C. Libani*) to the Syrian uplands in Asia Minor; and the third (*C. Atlantica*) to mountainous country in North Africa. He is assured that no true cedar-tree has ever been found in the natural forests of America. Later he discovers that north-west America is a large exporter of cedar timber. Only after long hours of patient searching in books on botany and forestry does he solve the puzzle by finding that American cedar is juniper-wood, or some other wood with the appearance and odour of cedar but not botanically connected with the genus *Cedrus*. If the botanical names and common names of the several timbers were always bracketed together students would be saved a great deal of trouble and waste of time. And, what is still more important, people engaged in the timber trades would be placed in a position to describe and discuss intelligently the various kinds of wood they have to handle or to offer for sale.

The Eucalypts.

Common or vernacular names are applied to trees and other plants in two quite distinct ways. In the one case they denote groups of species; in the other, individual or separate species. As group names they may be useful; as specific names they are generally unnecessary and often misleading. The distinction is very important. It is especially important in the study of the eucalypts. Botanical research to date has named and described over three hundred and fifty distinct forms of *Eucalyptus*. The great majority of the forms are ranked as species; a few as hybrids. A considerable percentage of the species fall into natural groups that have received vernacular names. The validity of the grouping and naming of the groups has been admitted generally by botanists. Where the vernacular names conspicuously fail is not in their application to groups, but in the attempt to use them as specific names. The position will be made clear if we present the case for three of the principal groups by way of illustration.

"GUMS."

A large number of the eucalypts shed their dead bark from their branches and stems, and present a pale-coloured and naked appearance to the eye. These smooth or naked-barked trees are technically called "gums." They vary over a wide range in botanical characters, and are divided into several subgroups, the one common character being the naked bark. There are the "red-gums": they are so called from the red colour of their timber. There are the "blue-gums," which are supposed to be distinguished by a bluish aspect of foliage and bark. There are the "white-gums" and "grey-gums," so named from the appearance of the bark alone. The one thing common to all these "gums," let us repeat, is the shedding of the dead bark and naked appearance of branches and stems. The grouping cannot claim to be scientific, but it stands in a general way for truth, and does not necessarily lead to confusion.

But the moment we attempt to separate one "gum" tree from another by means of vernacular names we find ourselves in difficulties. We have to use adjectives and epithets that are always liable to be misunderstood and misapplied. If we call *Eucalyptus rostrata* "river red-gum," and *E. tereticornis* "forest red-gum," we leave other "red-gums" still to be distinguished and load ourselves with long names to no useful purpose. In a similar way we cumber ourselves with long and quite unnecessary terms if we call *E. globulus* "Tasmanian blue-gum," and *E. saligna* "Sydney blue-gum." If we name *E. viminalis* "manna-gum" we must explain that several other eucalypts exude from their leaves the white, sweet substance called in Australia "manna." If we tell people that *E. cladocalyx* is the "sugar-gum" we are suggesting a property not possessed by this or any other *Eucalyptus* tree. If we get a little lower down, and call *E. coriacea* a "cabbage-gum," we shall send people's thoughts to the vegetable-garden instead of to the forest.

Education by confusion is impossible. The first condition for discerning and remembering truth is clearness. A "gum" tree is not *any* eucalypt, but a smooth-barked eucalypt; and the smooth-barked group includes several species. To distinguish the species and to exclude all confusion we must use the botanical names and suppress the vernacular names. In this procedure science and trade must be in agreement.

"STRINGYBARKS."

Turning from the "gums," we find numerous eucalypts that retain their dead bark on their stems and more or less on their branches. In one group the persistent dead bark is distinctly fibrous or even stringy. The trees are called "stringybarks," and the name as applied to the group is obviously appropriate. But there are fifteen or sixteen members of this "stringybark" group, and the task of discriminating them by adjectives or other words in the vernacular language becomes bafflingly difficult. In strict truth, it becomes impossible.

E. obliqua has sometimes been called the "Tasmanian stringybark"; but the species has a wide range on the mainland as well as on that island, and cannot be properly designated by a name that restricts its habitat to Tasmania. It was thought at one time that "messmate" might be a good name for this tree, but other claimants to this name came in and spoiled the proposal. *E. Muelleriana* is sometimes called "yellow stringybark" because of the yellow colouring in its inside bark; but *E. cugenioides* often shows the same character. The name thus fails as having a dual application. "Brown stringybark," "white stringybark," and "red stringybark" are all in as bad a case. By different people and in different localities they are all liable to interchange and confusion. Even if these adjectives were appropriate and could stand there would not be enough of them to go all round the group.

The one feasible conclusion is that here, as in the case of the "gums," the whole of the common names should be suppressed and the botanical names brought exclusively into use.

"IRONBARKS."

"Ironbark" is a group name applied to eucalypts that carry dead bark of a very firm, deeply furrowed, and non-fibrous character on

their stems and main branches. With the progress of research the number of species included in the group has increased from five up to eleven or more. The tests by which we determine an "ironbark" are bark and texture of wood. Leaves and fruits differ with the several species. In the bush and in the timber-yards we hear about "grey ironbark," "red ironbark," "narrow-leaved ironbark," and "broad-leaved ironbark." The terms are familiar vernacular names for some of the most valued members of the group. Long usage seems to have given them a secure place in nomenclature. Upon close scrutiny, however, every one of them fails to make good its claim to permanence. *E. paniculata* is sometimes described as "grey," sometimes as "white," sometimes as even "red." No one of these adjectives is securely and exclusively wedded to it; no one of them carries a description of the species. The botanical name alone can rescue this eminently valuable tree from uncertainty and confusion. *E. sideroxylon* has very red wood and is commonly called "red ironbark," but, being unable to maintain a monopoly of the word "red," it, like its congener, must take refuge under the botanical name for positive identification. For a long time *E. crebra* was known as the "narrow-leaved ironbark," and *E. siderophloia* as the "broad-leaved ironbark," but now each of those names has another acknowledged claimant in the group, and we are accordingly confronted with uncertainty in using them. Again the botanical names offer the only refuge from confusion.

OTHER GROUPS.

Other fairly well defined groups of the timber-yielding eucalypts are the "boxes," the "peppermints," the "bloodwoods," and the "mahoganies." The group names are sufficiently appropriate to admit of defence; but when we come to scrutinize closely the common names applied to the several species in each group we find that most of them fail hopelessly in respect to the conditions that render names for natural objects appropriate, exclusive, and trustworthy.

LISTS FOR CATALOGUES.

Catalogue-makers perhaps need a word of warning against introducing into their lists the vernacular names of *Eucalyptus* species because of their sound or appearance. Such names as bangalay, bimbil box, coolabah, Camden woollybutt, mountain-ash, swanp-gum, tuart, York gum, and red tingle tingle may be thought to add interest to a catalogue, but in reality they only waste time by diverting the attention of busy foresters and nurserymen away from the things they most urgently need to know to things of relatively trivial importance. The proper place for all these vernacular names is in a historical monograph, not in a working catalogue for the twentieth century. There are strong reasons why even such familiar names as jarrah and karri should step back in favour of the botanically registered *E. marginata* and *E. diversicolor*. "Blackbutt" means in middle New South Wales *E. pilularis*; farther north in New England it means *E. Andrewsi*; away in south Western Australia it is the common name for *E. patens*. In New South Wales "spotted gum" usually denotes *E. maculata*; in Victoria we may find people calling *E. goniacalyx* or *E. Maiden* by that

name. Terms so variable in application are disqualified for use in exact language. Their fitting place, like that of so many others, would be in the suggested historical monograph on the *Eucalyptus* common names for all Australia.

SUGGESTIONS.

Very much that might be cited in discussing the nomenclature of the eucalypts has been omitted from this paper for the sake of brevity, but enough has been said to suggest the following conclusions:—

(1.) As applied to groups of species some of the vernacular names are permissible and even useful.

(2.) As applied to separate or individual species these vernacular names almost invariably lead to uncertainty, and frequently to confusion.

(3.) In the interests of both science and trade the botanical names should be brought more fully into use, and the use of vernacular names everywhere discouraged.

(4.) Omission from the catalogues of all vernacular names would make room for instructive notes on the derivation of the scientific names and on the natural habitats and characters of the plants.

(5.) Botanists, foresters, nurserymen, and the timber trades should combine to put the nomenclature of timber-trees and their product on a thoroughly scientific and business-like footing.

WHEAT MANURIAL TRIALS AT CANTERBURY AGRICULTURAL COLLEGE, SEASON 1925-26.

M. J. SCOTT, B.A., B.Sc., A.I.C., Canterbury Agricultural College, Lincoln.

UP to the season 1924-25 wheat manurial trials at Lincoln College were undertaken in conjunction with the Department of Agriculture, Christchurch, chiefly to find out the value of organic nitrogen as blood. During that time attention was mainly directed to methods of estimating yields, &c., and when the Department took over the work of the Soils Improvement Committee it continued the work on blood. Readers are referred to the article by Messrs. Ward and Hudson—"Wheat Manurial Tests in Canterbury"—published in this *Journal* for August, 1925, also to the article by Mr. Hudson on the 1925-26 departmental experiments, which appeared in the issue for August last. In 1924-25 experimental work at the College was directed to the effect of (a) various quantities of the same kind of phosphate, and (b) the same quantities of different kinds of phosphate. This work was followed up in the 1925-26 season, and the results are recorded in the notes and data which follow.

(A.) The application of various quantities of the same kind of phosphate, basic super being used: The results from using 2 cwt. (average increase of 6.8 bushels per acre) and 3 cwt. (average increase of 9.5 bushels) over 1 cwt. per acre had been so striking that it was decided for the 1925-26 season to try 4 cwt. per acre. The results were quite a reversal of those of the previous season, thus forcibly stressing the point that seasonal variations are so dominant that all

Table 1.—Comparison of Different Quantities of the Same Kind of Phosphates.

Basic Super. per Acre.	Average Number of Sheaves, on 1 Acre (10 Counts)	Average Weight of Sheaves (80 Weighings).	Average Percentage of Grain to Total (40 Samples).	Yield per Acre.	Difference from 2 Cwt. per Acre	Value of Difference at 6s. per Bushel.	Difference from 2 Cwt. per Acre in Cost of Manure.	Profit (-) or Loss (+) per Acre.
Field 39: Sown, 23rd-26th May, 1925; cut, 20th-30th January, 1926. Previous crop, peas.								
Cwt.				Bushels	Bushels.	£ s. d.	£ s. d.	£ s. d.
1 ..	140.0 ± 5.1	11.6 ± 0.09	41.3 0.43	44.5 ± 1.6	- 4.3	- 1 5 6	- 0 6 6	- 0 19 0
2 ..	150.5 ± 3.4	11.2 ± 0.11	41.8 ± 0.53	48.8 ± 1.3				
3 ..	150.0 ± 2.8	11.4 ± 0.10	40.2 ± 0.46	47.2 ± 1.1	- 1.6	- 0 9 7	+ 0 6 6	- 0 16 1
4 ..	152.5 ± 5.0	11.45 ± 0.11	40.0 ± 0.48	47.2 ± 1.7	- 1.6	- 0 9 7	+ 0 13 0	- 1 2 7
Field 15A Sown, 12th-21st June, 1925; cut, 27th-28th January, 1926 Previous crop, Algerian oats								
1 ..				35.9 ± 2.1	- 2.4	- 0 13 5	- 0 6 6	- 0 6 11
2 ..				38.3 ± 1.2				
3 ..				30.4 ± 0.7	+ 1.1	+ 0 6 7	+ 0 6 6	+ 0 0 1
4 ..				37.8 ± 1.2	- 0.5	- 0 3 0	+ 0 13 0	- 0 16 0

Yields estimated by thrashing ten small plots from each treatment, as described by Hudson in his trials

experimental work must be carried on for many years before reliable information can be obtained. Details of the season's results are set out in Table 1 (preceding page).

Super is the universally used wheat-manure, but in view of the fact that 3 cwt. per acre destroys the germination of turnip-seed it was thought rather risky to sow large amounts over big areas. One small plot was tried, however, and the germination carefully compared with that on a plot having 1 cwt. of basic super per acre. The results of germination counts were as follows, averages being taken from ninety counts on 6 ft. rows:—

		Average Number of Plants on 6 ft.	
Super, 4 cwt.	46.3 ± 0.71.
Basic super, 1 cwt.	46.6 ± 0.74.
Difference	0.3 ± 1.01 (i.e., non-significant).

(B.) A comparison of the yields from the same quantities of tricalcium phosphate supplied as (1) Walpole Island guano, (2) Ephos, (3) super, (4) basic super, (5) basic slag. An amount of 95 lb. of tricalcium phosphate per acre was applied in each case as shown in Table 2.

Table 2.—Phosphates used in "B" Trials.

Kind.	Quality.	Amount of Manure required to supply 95 lb. of Tricalcium Phosphate per Acre.		Fineness—Percentage passing through 100-mesh Sieve.
		Per Cent.	lb.	
Walpole Island guano	..	60	155	62
Ephos	..	60	153	75
Super	..	42-44	224	Water-soluble.
Basic super	..	30-38	260	
Basic slag	..	30-38	260	

The results are shown in Table 3 (opposite page).

Reference has been made elsewhere to the relationship between the variations in the number of sheaves per acre and the corresponding variations in the yield on differently manured plots in the same field. (See also *Journal of Agricultural Science*, Vol. xvi, No. 2, W. A. Mackenzie, note on a remarkable correlation between grain and straw obtained at Rothamsted.) This point is again strikingly brought out, and encourages the hope that wheat manurial trials of this nature may possibly be very much simplified in the future.

Correlation coefficients between yields and numbers of sheaves are as follows:—

Field.					Correlation Coefficient.	
39	..	..	..	..	+ 0.955	± 0.045
15A	..	..	..	..	+ 0.924	± 0.075
15	..	..	..	..	+ 0.947	± 0.045
25	..	..	..	..	+ 0.674	± 0.202

The 1925-26 season in Canterbury was of an abnormal character on account of the very heavy winter rains, and it may be expected that the current season's results will be a complete reversal of those of last year. Reliable conclusions and explanations will be better made in five or six years' time.

Table 3—Results with Different Kinds of Phosphates.

Kind.	Average Number of Sheaves on $\frac{1}{4}$ Acre (12 Counts).	Average Weight of Sheaves (80 Weighings)	Average Percentage Grain to Total (40 Samples).	Yield per Acre.	Difference from Super, per Acre.	Value of Difference at 6s. per Bushel.	Difference in Price of Manure per Acre (2 Cwt. Super as Standard).	Profit (+) or Loss (-) per Acre.
Field 25: Sown, 25th-26th May, 1925; cut, 30th January, 1926. Previous crop pasture (good red clover).								
Guano	117.5 \pm 4.2	11.5 \pm 0.10	38.1 \pm 0.49	34.2 \pm 1.3	-3.8	l s. d. -1 2 9	l s. d. -0 2 9	l s. d. -1 0 0
Ephos	122.5 \pm 9.0	11.6 \pm 0.08	40.6 \pm 0.46	38.4 \pm 2.8	+0.4	+0 2 5	-0 2 9	+0 5 2
Super	115.0 \pm 7.1	12.1 \pm 0.07	41.8 \pm 0.42	38.0 \pm 2.4				
Basic super	132.0 \pm 6.5	11.8 \pm 0.09	40.8 \pm 0.41	42.4 \pm 2.4	+4.4	+1 6 5	+0 1 9	+1 4 8
Basic slag	132.0 \pm 3.9	11.6 \pm 0.07	38.5 \pm 0.50	39.3 \pm 1.0	+1.3	+0 7 9	+0 1 9	+0 6 0
Field 15: Sown, 1st-8th June, 1925, cut, 25th-27th January, 1926. Previous crop, rape or oats and tares.								
Guano	153.8 \pm 4.0	11.5 \pm 0.14	39.0 \pm 0.26	46.0 \pm 1.4	-4.4	-1 6 5	-0 2 9	-1 3 8
Ephos	167.0 \pm 4.9	12.8 \pm 0.11	39.0 \pm 0.39	55.6 \pm 1.8	+5.2	+1 11 2	-0 2 9	+1 13 11
Super	153.7 \pm 5.1	12.6 \pm 0.07	39.0 \pm 0.32	50.4 \pm 1.7				
Basic super	161.0 \pm 4.6	12.6 \pm 0.07	38.7 \pm 0.29	52.4 \pm 1.6	+2.0	+0 12 0	+0 1 9	+0 10 3
Basic slag	145.0 \pm 4.6	12.2 \pm 0.11	38.4 \pm 0.40	45.3 \pm 1.6	-5.1	-1 10 1	+0 1 9	-1 11 10

CATTLE-TICKS AND REDWATER.

EXPERIMENTS INDICATE THE NEW ZEALAND TICK AS NON-CARRIER OF PIROPLASMOSIS.

PIROPLASMOSIS or redwater in cattle is a disease caused by a microscopic blood parasite which is carried from animal to animal by blood-sucking external parasites. In parts of Australia cattle are affected with *Piroplasma bigeminum*, and the disease commonly called redwater or Texas fever is carried by a tick, *Margaropus annulatus* var. *australis*. The latter differs in habits to a marked extent from our New Zealand cattle-tick, *Haemaphysalis bispinosa*, by attaching itself to one host throughout its growing stages, whereas the New Zealand tick, which requires three hosts, drops off one host to moult and then attacks a further host between moults until the adult stage is reached.

Cattle attacked by the piroplasm may be acutely affected and die from an intense breakdown of blood-cells which makes the urine claret-coloured, or they may be more chronically affected and die from emaciation and anæmia. Young cattle bred in a district where ticks and piroplasmosis are present may gain a tolerance to the disease, and imported cattle may be given this tolerance by inoculation of the disease intentionally at the quarantine station. If the tick is eliminated from diseased herds there can be no transmission of disease from animal to animal, but the blood parasite does not die out in the affected animal, and with a new advent of tick redwater once more breaks out in an intensified form owing to lack of resistance of the younger stock.

Piroplasmosis is not present in New Zealand, but it was considered necessary to clear up the point whether our cattle-tick might not act as a carrier should the disease ever reach this country. In order to obtain definite knowledge on this question an experimental investigation was undertaken, at the request of the New Zealand Department of Agriculture, by Mr. John Legg, Queensland Government Veterinary Surgeon, at the Government Laboratory at Townsville, in that State.

In his experimental work Mr. Legg was provided with a number of New Zealand cattle-ticks by this Department. These ticks were bred and at their different stages of growth fed by being allowed to engorge on the blood of infected animals. They were then allowed to go one step further in their life-cycle and were placed on animals free from disease. In no case was it found possible to transmit by this means the disease from affected to clean cattle. In control experiments, however, the clean cattle were later readily infected experimentally. Bulls from which infected blood was obtained were able to infect clean cattle at any time during the experiments, so that every opportunity was afforded the New Zealand tick to become a carrier of the disease. In the case of the Australian cattle-tick the blood parasite can be transmitted from the adult to the tick egg, and so to cattle in the young larvæ hatching from the egg. Experimental work shows this not to be possible with the New Zealand tick.

The important conclusions arrived at by Mr. Legg from his experimental work as to the non-carrying characteristic of the New

Zealand tick in connection with piroplasmosis are very satisfactory. Some further experimentation will be desirable, however, before they can be absolutely accepted, and we are in correspondence with Mr. Legg regarding this. Mr. Legg's interest and valuable work in connection with the investigation have had the highest appreciation of the Department of Agriculture.

An article on the subject of his investigation, contributed by Mr. Legg to the *Australian Journal of Experimental Biology and Medical Science*, Vol 3, part 4 (December, 1926), gives details of the experiments and results obtained.

—C. S. M. Hopkirk, B.V.Sc., Officer in Charge, Wallaceville Veterinary Laboratory.

THE GROWTH OF PHORMIUM TENAX.

G. SMERLE, Kaihere, Hauraki Plains.

IN order to determine the growth and age of phormium-leaves the writer selected two varieties of healthy appearance, cut them by the side-leaf method on 11th December, 1925, and counted the leaves on 13th October, 1926. By the side-leaf method the three centre leaves of the plant are not cut, but are left in the fan to enable the plant to continue its growth*. All the leaves were marked as soon as they appeared in the centre, and indelible pencil was used to write the dates on the leaves. The experimental plants were growing wild in the swamp near the writer's mill, and did not receive any cultivation or manuring.

The experiment showed that the fan produces from five to eight leaves a year, the average production here (Hauraki Plains) being six and a half leaves a year, and the age of the leaf from fifteen to twenty-two months. The twenty-two-months-old leaf is nearly dead, and for milling purposes would be of very little value. A leaf of twelve months in many instances shows signs of old age, and if left longer uncut would give lighter and discoloured fibre. Especially in the tip of the leaf the fibre would be poorer than in a younger leaf. The leaf would be at its best for fibre-production at the age of ten to twelve months.

By cutting with the hook every four years one gets from nine to eleven leaves to a fan. By this method of cutting the centre leaf is invariably lost in the stripping process, so there are only eight to ten leaves in four years from which fibre is obtained.

Following are the results of the experiment in detail, the dates given referring to the appearance of the respective leaves—one leaf in each case:—

No. 1 fan: 1st July, 1925, 3rd October; — December; 8th January, 1926; 12th February; 10th April; 30th May; 12th July; — October. Seven leaves in the twelvemonth between October, 1925, and October, 1926.

No. 2 fan: 1st August, 1925; 10th October; 10th November; 8th December; 25th January, 1926; 25th March; 5th May; 8th July; 10th October. Eight leaves in the twelvemonth, October to October.

* For a full description of the side-leaf method see article "Improvement of *Phormium tenax* for the Fibre Industry," published in this *Journal*, June, 1923.

No. 3 fan: 3rd July, 1925*; 28th September*; 17th December; 25th January, 1926; 27th March; 7th May; 10th July; — October. Six leaves in the twelvemonth ended October, 1926.

No. 4 fan: 20th September, 1925; 10th October; 6th December; 23rd January, 1926; 23rd March; 4th May; 16th July; — October. Six leaves in the twelvemonth ended October, 1926.

No. 5 fan: 25th August, 1925; 9th October; — November; 27th December; 10th February, 1926; 23rd March; 9th May; 17th July; 1st August. Seven leaves in twelvemonth ended August, 1926.

No. 6 fan: 10th July, 1925; 1st November; 17th November; 12th December; 25th January, 1926; 10th August; — October. Six leaves in twelvemonth ended October, 1926.

No. 7 fan: 29th June, 1925; 1st August; 10th October; 4th December; 2nd February, 1926; 12th April; 18th June; — October. Five leaves in twelvemonth ended October, 1926.

No. 8 fan: 20th July, 1925; 10th October; — November; 6th January, 1926; 10th February; 1st April, 22nd May, 12th July; — October. Seven leaves in twelvemonth ended October, 1926.

No. 9 fan: 26th June, 1925; 20th September; 8th October; 10th December; 17th January, 1926; 25th February; 12th April; 26th June, — October. Six leaves in twelvemonth ended October, 1926.

Another experiment was carried out on the growth in two years of a planted fan. This fan was planted on 8th October, 1924. Some of its leaves are about 7½ ft. long, and at time of writing there are two young fans with leaves from 3 ft. to 5 ft. in length. The leaves in this fan appeared as follows:—

27th October, 1924*; 10th January, 1925*; 20th June*; 22nd August; — November; 1st February, 1926; 20th March; — May; 25th June; 10th August; — September. Seven leaves in twelvemonth ended September, 1926.

The best growing season for phormium on the Hauraki Plains—and probably all over New Zealand—according to these experiments is from October to March inclusive; from March to June growth is medium; and the poorest season for growth is from June to October.

* Dead or dying at date of observation—18th October, 1926.

National Arboretum.—The last annual report of the State Forest Service states that the original area of 50 acres acquired for the establishment of the national arboretum at Rotorua has been extended by the acquisition of 29 acres of adjoining land. Stocks of about two hundred and fifty indigenous and exotic species are being raised in the Whakarewarewa Nursery for the arboretum, and the first instalment of specimens will be planted therein during the 1928 planting season. Every effort is being made to make the arboretum fully representative of the world's principal softwood utility and ornamental trees.

Orchard Production.—The quantities of fruit produced by commercial orchards in New Zealand during the season 1925–26 are given by the Census and Statistics Office as follows: Apples, 1,935,489 bushels; pears, 179,207 bushels; peaches, 105,171 bushels; nectarines, 15,007 bushels; apricots, 67,295 bushels; plums, 54,332 bushels; cherries, 8,149 bushels; oranges, 5,649 bushels; lemons, 22,369 bushels; quinces, 2,577 bushels. Walnuts, 1,394 bushels, and almonds, 11 bushels, are also returned.

Want of drainage is indicated mainly by the herbage growing on the land, such as rushes, sedges, &c. Unless the primary soil conditions that produce these undesirable plant-growths are removed the agricultural value of the land will remain low.

CHEESE-CRATE TESTS.

DEVELOPMENT OF BALANCED CONSTRUCTION TO MINIMIZE BREAKAGE DURING TRANSIT.

A. R. ENTRICAN, Engineer in Forest Products, and W. C. WARD, Forest Assistant, New Zealand State Forest Service.

COMPLAINTS have been received from time to time relative to the damage to cheese which takes place in export service, due to the failure of the containers used. This article presents the results of tests made by the Forest Service on behalf of the Dairy Division of the Department of Agriculture, with the object of improving the serviceability of cheese-crates at present used in the export trade. The work carried out is similar to that described in the article entitled "Butter-box Tests," published in the issue of this *Journal* for May last.

The laboratory studies here described combine practical experience—which is a knowledge of the designs in use, of what timber is available, and of crate-manufacturing practice—with actual scientific tests made on the package itself, packed as in actual service and subjected to strains that approximate actual transportation conditions.

The main purpose of the study was to develop a balanced and economical construction—that is, a crate which has enough strength in each part for the purpose for which it is intended, and no more strength in any part than is necessary to balance the average strength in any other part. The essential qualifications of an export cheese package are (1) that it be strong enough to stand up under exceptionally rough handling; (2) that it be able to resist punctures from the corners or edges of other containers; (3) that it occupy a minimum of space; and (4) that it be difficult to open or close without special tools—a preventive of concealed pilfering. It is necessary to secure these four qualifications without a burdensome cost.

Although the immediate purpose was to formulate a specification for a standard crate for the export trade, the scope of the work was extended to include a study of the various types of containers now in common use, and to provide data for the general instruction of crate manufacturers and users regarding certain fundamentals of crate design. The study may be still further extended at a later date to the investigation of other types of cheese-containers which appear to promise improvement upon existing packages.

Material tested.

STANDARD CRATE.

The standard cheese-crate now in common use for the export trade carries two cheeses weighing approximately 80 lb. each. The crate is an approximately cylindrical package, having two compartments, as shown in Fig. 1. It is constructed of two ends and one centre-piece, with these twelve-sided single pieces connected together by twelve battens approximately $27\frac{1}{2}$ in. in length.

Most of the tests described in this report were made upon packages approximating to the foregoing standard, the length of all the battens used being kept constant at 27 in. One small series of tests was made upon a crate designed to carry only one 80 lb. cheese. The battens of this crate are $13\frac{1}{2}$ in. in length.

The distance between parallel sides of ends and centres was kept constant at 15 in. for both standard and single cheese-crates. In assembling the standard crates the directions of the grain in the two ends are placed at right angles, the grain of the centre running diagonally between that of the ends. Each batten in the standard crate is attached to each end and centre by two smooth wire nails, $1\frac{1}{4}$ in. long. The whole crate is reinforced by three 14 B.W.G. soft iron wires, fastened around the centre and each end by $\frac{3}{4}$ in. staples driven into the ends and centre between all battens.

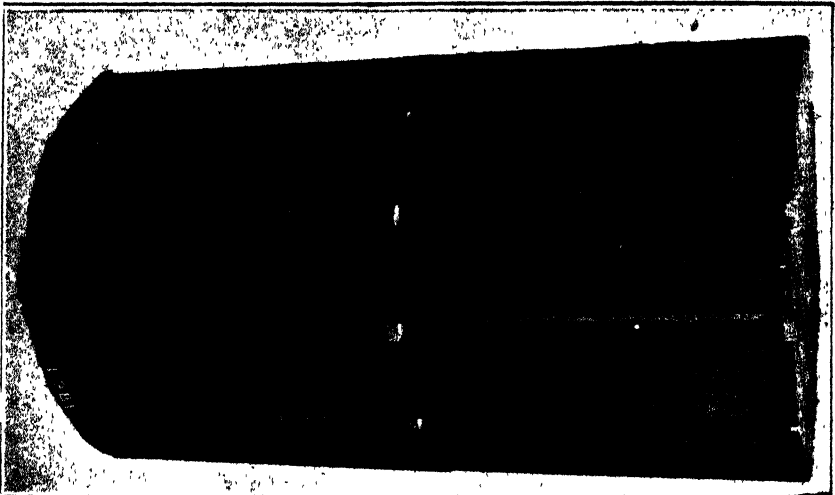


FIG. 1. STANDARD EXPORT CRATE.

Many failures or breakages in cheese-crates having been attributed to poor nailing and reinforcing, tests were accordingly made to determine the effect of substituting cement-coated nails for smooth wire nails, and flat nailed strapping and Acme flat nailless strapping in tension for the reinforcing-wire.

"MAT" CRATE.

As the standard crate is assembled and opened only with considerable difficulty, tests were made of other types of construction which appeared to minimize this disadvantage. One of these types—the "mat" crate—is shown in Figs. 2 and 3. Fig 3 shows a section of a "mat" delivered from a stitching or fabricating machine and ready to be nailed to the ends and centres. The battens are held to the wooden hoops by means of staples. The crate is assembled by folding the mat around the ends and centres, and placing another wooden hoop exactly

over the hoop to which the battens are stitched. Nailing through the hoops is commenced in the centre of the mat, and each succeeding batten nailed, working round to half-way, when the cheese is placed in position and the nailing completed. Fig. 2 shows the assembled crate.

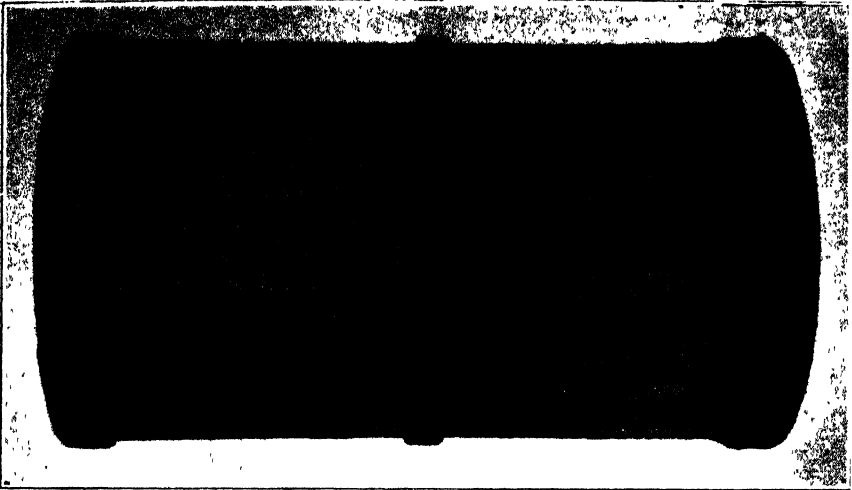


FIG. 2. ASSEMBLED "MAT" CRATE

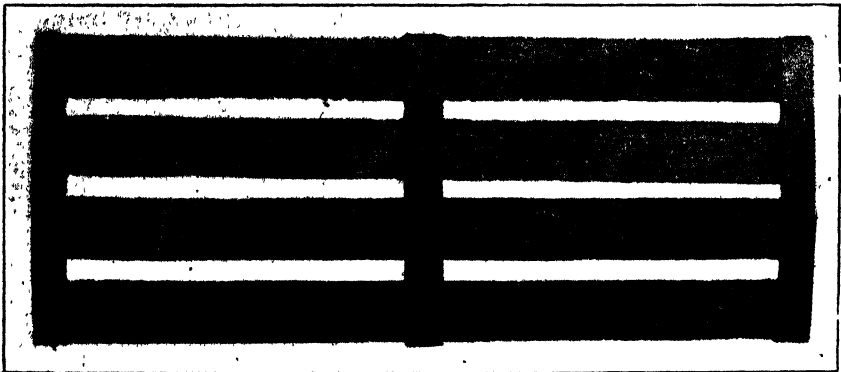


FIG. 3. PORTION OF MAT CRATE, SHOWING BATTENS STITCHED TO HOOPS.

"CLEATED" CRATE.

Standard-sized and single cheese-crates similar to those shown in Figs. 4, 5, and 6 were also tested. These crates are constructed in two halves, which are assembled around the cheese or cheeses and fastened together by cleats at the ends and reinforced by Acme flat metal strapping.

GENERAL.

Five crates were tested to study each variable. The results in all cases were consistent enough to give a reliable average based on this

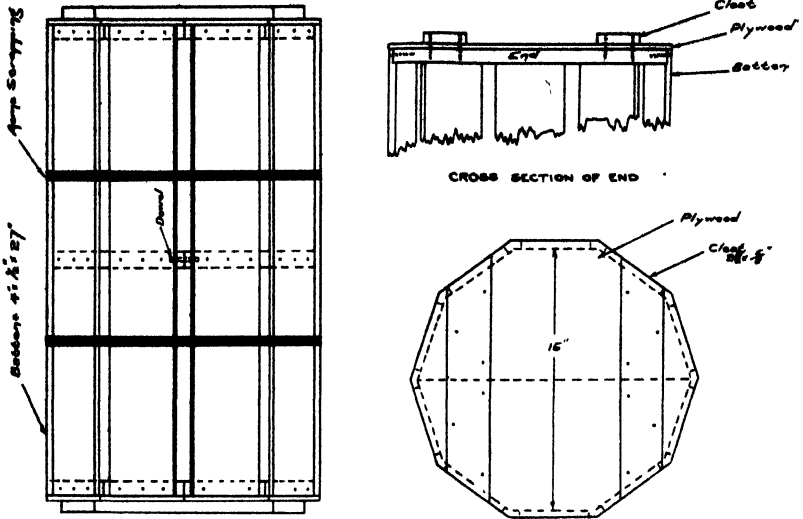


FIG. 4. CLEATED CRATE OF STANDARD SIZE.
In the tests reviewed the ply-wood packing was omitted.

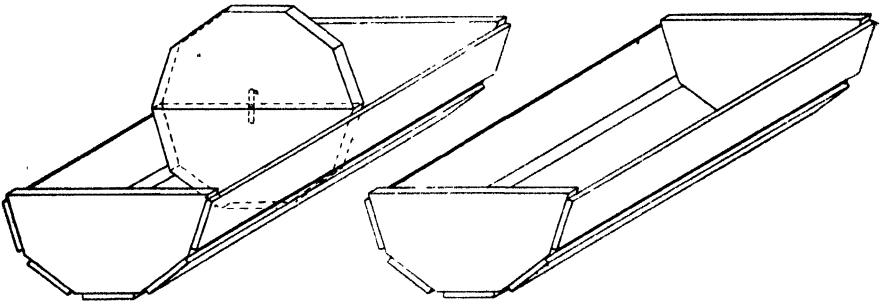


FIG. 5. CLEATED CRATES, SHOWING METHOD OF CONSTRUCTING CRATE IN TWO HALVES

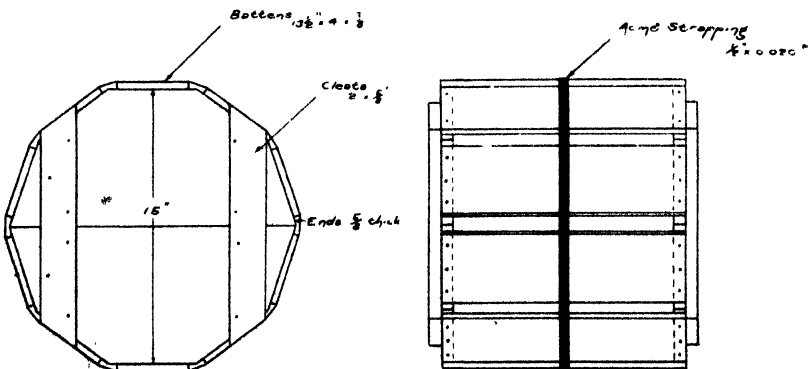


FIG. 6. CLEATED CRATE TO HOLD ONE 80 LB. CHEESE.

number of tests. The recommendations of the Madison Forest Products Laboratory, U.S.A., were followed in the nailing and strapping of crates. Only 5D and 7D cement-coated nails were procurable from local stock. It was therefore necessary to use these in some cases where 6D would have proved more suitable. Flat iron nailed box-strapping, $\frac{1}{2}$ in. wide by 0.015 in. in thickness, and No. 14 B.W.G. iron wire, both of soft (*i.e.*, annealed) metal, were used on crates bound with nailed or stapled bindings. Acme flat metal strapping, $\frac{1}{2}$ in. by 0.018 in. and $\frac{3}{8}$ in. by 0.015 in., both of hard (*i.e.*, unannealed) metal, were used on crates bound with nailless bindings.

NOTE.—The size of cement-coated nails is expressed in pennies and designated throughout this article by the letter "D." The dimensions are as follows: 4 penny (4D), $1\frac{3}{8}$ in. long, 14 A.W. gauge; 5 penny (5D), $1\frac{1}{2}$ in. long, 13 $\frac{1}{2}$ A.W. gauge; 6 penny (6D), $1\frac{1}{4}$ in. long, 13 A.W. gauge; 7 penny (7D), $2\frac{1}{8}$ in. long, 12 $\frac{1}{2}$ A.W. gauge. Cement-coated nails are designated by letters "c.c."

Methods of Test.

TESTS OF CRATES.

The most practical method yet devised for testing wooden packages is the revolving-drum test. For this purpose the machine shown in Fig. 7 was installed by the Forest Service at its timber-testing station maintained at the School of Engineering, Canterbury College, Christchurch. The drum is a hexagon-sided machine, and revolves slowly at a rate of $1\frac{1}{8}$ revolutions per minute. The crate to be tested is packed with cheeses of ordinary weight, as in commercial service, and

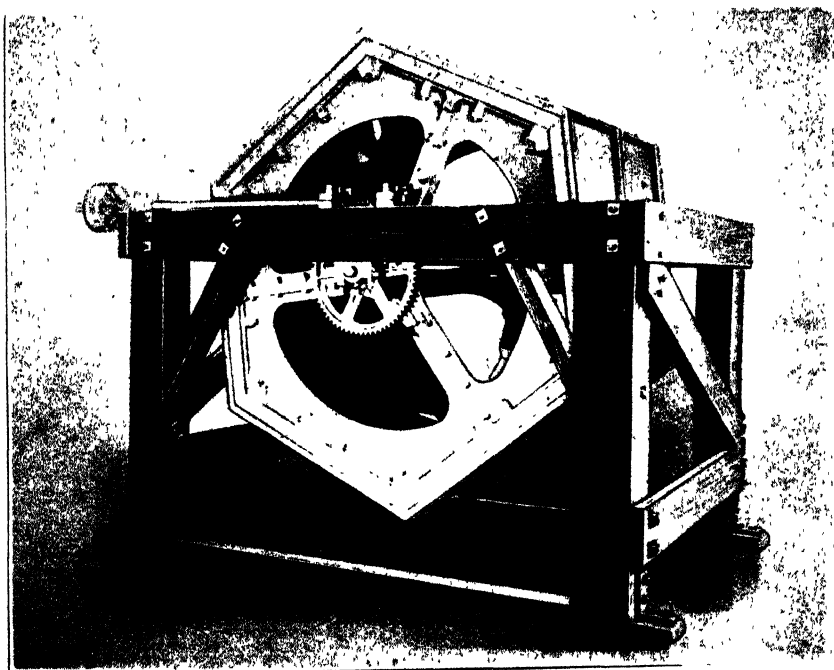


FIG. 7. REVOLVING-DRUM BOX-TESTING MACHINE.

placed in the drum. In the drum are arranged a series of hazards which cause a crate to follow a regular cycle of drops, falling on battens, ends, and edges, and flatwise upon a projection similar to the corner of a box. These drops simulate the usual hazards of transportation. Each face of the drum is counted as one drop.

To facilitate the recording of locations and character of failures the battens and ends of the crates were numbered. As the crate moves on from one drop to the next the observer notes the beginning of the failure of the weakest point of the construction, and follows its development and that of other weaknesses until the crate fails and spills its contents. The weak features of the crate may be too few or too short nails, thin battens or ends, or insufficient reinforcement in certain parts. Such weaknesses are studied by the observer until he is able to build up a crate having equal strength in every feature and capable of delivering its contents in the same condition as when first shipped.

TESTS OF REINFORCEMENTS.

The mechanical tests of the bindings and fastenings were made at the Forest Service timber-testing station maintained at the School of Engineering, Auckland University College.

Six tests of each type of reinforcement were made to determine the maximum tensile strength and percentage elongation of the metal used. As only the maximum tensile strength of the stapled-wire and nailed strapping was required, specimens were limited in length to 10 in. between grips. In tension strapping a low percentage elongation is necessary, and for this determination specimens 60 in. long between grips were tested. The speed of testing for all specimens was 0.024 in. per minute. Self-aligning grips were used throughout the work.

Results of Tests.

GENERAL.

The results of the tests confirm the practical experience of shippers both in New Zealand and abroad. They prove conclusively that the standard export crate as at present assembled is an unbalanced construction. The outstanding features of the tests were the weakness of the nailing and the low margin of safety given by the battens for the safe carriage of the contents of the crate.

Shippers and graders commonly remark upon both of these features. In practically every export shipment nails draw and protrude from crates, and where any laxity is displayed in the use of battens of any wood except beech, either below $\frac{3}{8}$ in. in thickness or of an inferior quality, excessive splitting and breakage occur. This is easily understood. In handling, if slips occur, the tendency is for crates to fall diagonally, and thus strike the ground or other surface where battens are nailed to the ends. Nails and battens are therefore called upon to absorb very high stresses. The use of a wire reinforcement round the ends and centres undoubtedly assists to absorb these stresses and to reduce the drawing of nails. The battens, however, tend to split, even with the best of reinforcement, and, strictly speaking, are too thin. The extent of these and other weaknesses, and the measures necessary to minimize them, are clearly set out in the analysis of results of tests.

ANALYSIS OF RESULTS.

The results of the tests are shown in a series of tables. A detailed description of the crates tested accompanies each table, which is confined as far as possible to the study of a single variable in design.

For convenience in making analysis, and in comparing other designs, the white-pine crate, requiring 330 drops to cause failure and conforming to the following specification, is taken as 100 per cent. :—

Battens—Twelve battens, each 27 in. long by $3\frac{1}{4}$ in. wide by $\frac{3}{8}$ in. thick.

Ends and centre—One piece, each twelve-sided, 15 in. between opposite parallel sides, by $\frac{3}{8}$ in. thick.

Nails—Two 5D cement-coated nails into each end and centre of battens.

Reinforcement—Three 14 B.W.G wires fastened around ends and centre with one $\frac{1}{2}$ in. staple between battens.

This is the standard export crate with cement-coated nails substituted for smooth wire nails.

EFFECT OF SUBSTITUTING CEMENT-COATED FOR SMOOTH WIRE NAILS

Details of Crates tested.

Number of Nails Two nails into the centre and ends of each batten

Reinforcement.—14 B.W.G wires fastened around the centre and each end with one $\frac{1}{2}$ in. staple between battens

Table I.

Timber.	Type of Nail.	Size of Nails.	Number of Drops required to spill Contents.	Relative Strength to Smooth-wire-nailed Crate.
White-pine ..	Smooth wire	5D	190	1.00
„	Cement-coated	5D	330	1.74
Norway spruce ..	Smooth wire	7D	119	1.00
„	Cement-coated	7D	210	1.76

Table I represents the results of tests upon four groups of crates nailed with ordinary and cement-coated nails. Crates manufactured from both Swedish spruce and New Zealand white-pine were used. The results were remarkably consistent, the cement-coated nailed crates of both species of wood showing a 75-per-cent. superiority over those fastened with smooth wire nails.

The method of failure of crates nailed with ordinary nails was typical of that which occurs in the export handling of cheese-crates. In all cases the nails tended to loosen early in the test, ultimately drawing where driven into the end grain and thus causing the ends to fail rapidly by splitting. This type of failure is illustrated in Fig. 8. It was sensibly reduced by the use of the cement-coated nails, which are recommended to shippers for both export and domestic service. The drawing of nails, in addition to weakening crates, also causes considerable damage to the clothes and hands of labourers. This is a serious disadvantage, largely eliminated by the use of cement-coated nails.

Cement-coated nails are used almost universally by box-manufacturers in Canada and the United States of America, as they have a much higher

resistance to withdrawal than plain uncoated nails. The cement coating of the nail consists of various resinous gums mixed by a secret formula and put on the nails by a baking process. Though the makers do not claim that the nails are absolutely rust-proof, they do claim that nails thus treated will resist the effects of moisture from 20 to 50 per cent. better than the uncoated wire nail. But it is when in use that the non-rusting quality is most evident. There is more coating on the nails than is actually necessary for holding-power. The heat caused by the friction in driving the nail softens the coating, and the surplus is forced towards the head, completely closing any opening; this prevents the admission of moisture between the wood and the nail. Under similar conditions of use the life of a cement-coated nail will be about twice as long as that of an uncoated one. They are claimed to require less force to drive, as the softened coating forms a lubricant. The advantages to be gained by the use of cement-coated

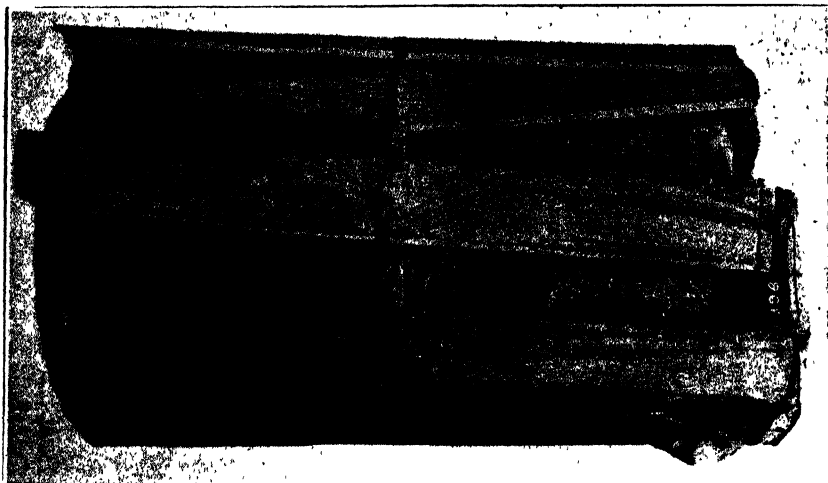


FIG. 8. TYPICAL FAILURE OF A CRATE NAILED WITH SMOOTH WIRE NAILS.

The nails have loosened early in the test, ultimately drawing from the end grain and causing splitting of the ends

nails are so great that it is very desirable that they should be universally adopted for boxing and crating work throughout New Zealand. Whereas a 2 in. cement-coated nail driven $1\frac{1}{2}$ in. into the side grain of a piece of American pine required a force of 226 lb. to withdraw it, a common nail under the same conditions was withdrawn with a force of only 106 lb. Complaints are sometimes heard regarding their flow in the nailing-machines, but no real difficulties will be experienced if powdered soapstone is mixed with the nails and the pans of the machines are not filled too full.

That cheese-producers have been alive to the poor holding-quality of the ordinary smooth wire nail is clear from the increasing use of barbed and twisted nails. While no tests were made of crates fastened with these nails, there is no doubt that they are superior to the ordinary smooth wire nail, although inferior to the cement-coated nail.

EFFECT OF VARYING SPECIES OF TIMBER USED.

Details of Crates tested.

Nailing.—Two 5D cement-coated nails into the centre and ends of each batten.

Reinforcement.—14 B.W.G. wires fastened around the centre and each end with one $\frac{1}{4}$ in. staple between battens.

Table 2.

Timber.	Number of Drops required to spill Contents.	Relative Strength to White-pine Crate.
White-pine	330	1.00
Beech	546	1.66
Spruce	101	0.31
Hemlock	98	0.30
Insignis pine	98	0.30

Increasing the holding-power of the nails, however, caused them to shear through the ends of battens, allowing the end to again fail by splitting. Resistance to this type of failure by various woods in common use for cheese-crates is shown in Table 2. The crates manufactured from silver-beech, the wood of greatest density or specific gravity, gave the best results. On the other hand, although the four woods—white-pine, spruce, hemlock, and insignis pine—are of approximately the same density, the serviceability of the white-pine crates was almost three times that of the other crates. This is probably accounted for by the fact that in white-pine there is little difference between the density of the summer wood and spring wood. In the other three species this difference is more marked.

At the same time it must be conceded that the quality of many white-pine crates commonly used is much below that of the specimens

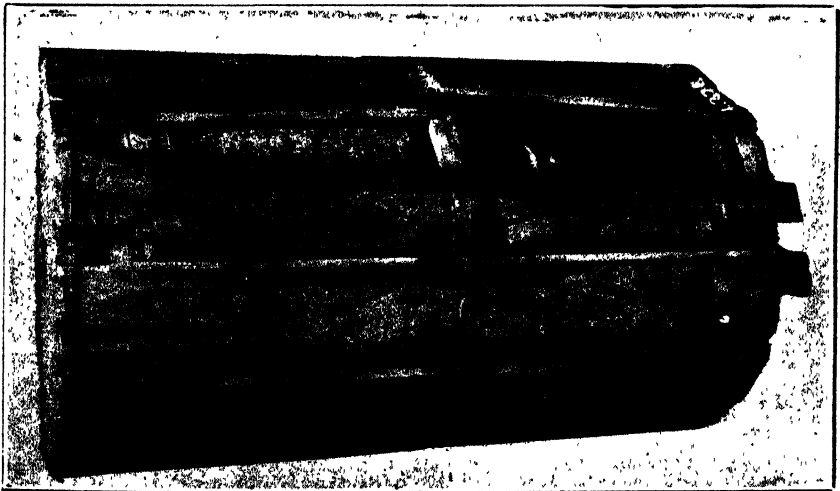


FIG. 9. TYPICAL FAILURE OF INFERIOR GRADE WHITE-PINE CRATE.

Knots and diagonal grain have reduced the strength of the crate by over 50 per cent.

tested. A group of such crates, tested to demonstrate the effect of quality of timber, in particular the effect of knots and diagonal and spiral grain, reduced the number of drops required to cause loss of contents to 128, thus showing a superiority of only 30 per cent. over the crates manufactured from the three other woods.

In appearance the hemlock and spruce crates were superior to the white-pine crates, and especially to the insignis-pine crates. The insignis-pine crate, indeed, was of inferior quality. Improved manufacture would produce a more serviceable package.

EFFECT OF VARYING SIZE OF NAILS USED.

Details of Crates tested.

Timber.—Norway spruce.

Nailing.—Two nails into the centre and ends of each batten.

Reinforcement.—14 B.W.G. wires fastened around the centre and each end with one $\frac{1}{4}$ in. staple between battens.

Table 3.

Size of Nails.	Type of Nails.	Number of Drops required to spill Contents.	Relative Strength to Crates nailed with 5D Nails.
5D	Cement-coated ..	101	1.00
7D	„ ..	210	2.08
5D	Smooth wire ..	58	1.00
7D	„ ..	119	2.05

Increased holding-power in nails also varies with their size. This is clearly indicated by Table 3, which again shows remarkable but not unexpected consistency in the gain in holding-power with length in both smooth and cement-coated nails of corresponding sizes. Increasing the length of $1\frac{1}{8}$ in. nails (by $\frac{1}{4}$ in., or 30 per cent.) to $2\frac{1}{8}$ in., according to these tests, increases the strength of spruce crates by over 100 per cent. In hemlock and insignis-pine crates a similar increase in strength would be attained, but in white-pine and beech packages the percentage increase would be smaller owing to battens failing before the nails could develop their full strength.

EFFECT OF REINFORCING CRATES WITH WIRE BINDING NOT IN TENSION.

Details of Crates tested.

Timber.—Norway spruce.

Nailing.—Two 7D c.c. nails into the centre and ends of each batten.

Reinforcement.—14 B.W.G. wire fastened to crate with one $\frac{1}{4}$ in. staple between battens.

Table 4.

Number of Reinforcements.	Number of Drops required to spill Contents.	Relative Strength to Unreinforced Crate.
None	36	1.00
2	69	1.92
3	210	5.83

Wire bindings applied over battens and fastened by staples driven into the ends and centre between battens absorb a large part of the stresses which would otherwise be borne by the nails. While the wire is placed on by hand without the use of any stretching-machines, the method of attachment results in the binding being placed under considerable tension. The wire is placed around the crate and the ends firmly fixed to a batten. A staple is then driven over the wire between the battens, thus drawing the wire between the battens down so as to touch the ends. Fig. 8 illustrates this, and shows the grooving of the battens where the wire has bitten into them.

The results of the tests set out in Table 4 show that two bindings placed over the ends almost double the strength of the package, while three bindings placed over both the ends and the centre increase the strength of the package six times.

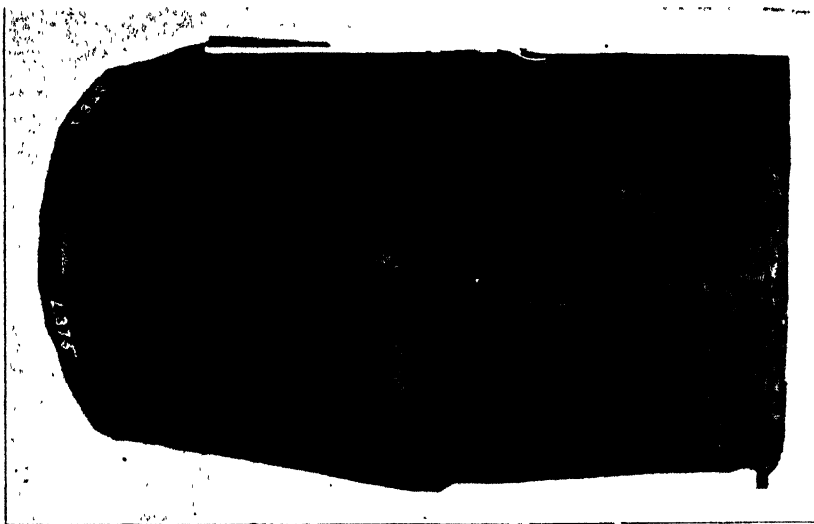


FIG. 10 TYPICAL FAILURE OF TWO-WIRED CRATE

The unreinforced central battens quickly bulge and break.

The unwired crate failed, by nails pulling through the ends of battens, allowing the ends to split. Applying two wires at the ends delayed this type of failure. The first weakness to develop was the drawing of nails at the centre, since a crate falling diagonally on an edge causes battens to act as slender columns eccentrically loaded at the ends. These, therefore, tend to bulge and break at the centre of their length. Immediately the centre became loose the crate skewed, the ends of battens again pulling through the nails. This is well illustrated in Fig. 10. A third wire applied at the centre effectively eliminated the weakness of the two-wired crate, the final failure occurring by battens breaking across the grain. The efficient stapling of the wire bindings is essential if the full strength of this type of construction is to be developed.

The superiority of the three-wired over the two-wired crate has long been known to the industry in various districts. In some, however,

there has been objection voiced to the third wire. The foregoing tests do not support the objections. An alternative has been proposed in one district to substitute a longer nail in the centre for the short nail together with the wire binding. With smooth wire nails this alternative would give almost as good results, but both constructions are unsatisfactory, as the smooth wire nails pull easily, causing the crate to fail rapidly and also causing damage to the clothes and hands of labourers. In the cement-coated nailed crates the superiority of the three-wired over the two-wired packages is very marked and clearly economical.

EFFECT OF REINFORCING CRATES WITH FLAT METAL NAILED STRAPPING NOT IN TENSION.

Details of Crates tested.

Timber.—New Zealand white-pine.

Nailing.—5D cement-coated nails.

Reinforcement.— $\frac{1}{2}$ in. flat metal nailed straps fastened around centre and each end of crate.

Table 5.

Nails per Batten.	Additional Nail-holding Strapping to Battens.	Number of Drops required to spill Contents.	Relative Strength to Unreinforced Crate.
Two 5D ..	Unreinforced ..	57	1.00
One 5D ..	Two 5D ..	291	5.11
One 5D ..	One 5D ..	328	5.76
Two 5D ..	One 5D ..	423	7.43

The poor finished appearance of the wire reinforcement, together with the damage caused to the clothes and hands of labourers, warranted the study of promising substitutes. The results of a series of tests upon crates reinforced with flat-nailed strapping are shown in Table 5. The finished appearance of this reinforcement is certainly good, as depicted in Fig. 1. It has the added merit of being more easily applied, but the crate is somewhat more difficult to open for weighing and inspection. The strapping, too, is more likely to tear or break between battens, causing damage to the clothes and hands of labourers, as in the case of wired crates. In nearly all crates in these groups one or more straps broke in this manner.

Efforts were made to secure the flat-nailed strapping in a manner similar to the wire binding—that is, by nails driven into the ends and centre between battens. This method of attachment proved a failure, due to the strap splitting away from the nails while driving, thus causing the strapping to break soon after the commencement of the test. The method of attachment finally developed consisted of applying the flat strapping without tension, merely driving the nails through the strapping and the battens into the ends. Fastening the battens to the ends and centre by one nail and the strapping to the battens by one nail gave a construction equivalent to that of the three-wired crate, in which the battens are attached by two nails and a wire binding applied over the battens. It has the added merit of eliminating the use of over forty staples per crate. The results of the tests, as would be expected, were the same as for the three-wired crates.

The strongest package, using this type of reinforcement, was assembled by using two nails per batten and affixing the strap with an additional nail through the strap into each batten. The extra strength was due solely to the extra nail. On the other hand, more than one nail per batten driven through the strap caused it to break early in the test, due to the reduction in the effective cross-section of the metal.

COMPARISON OF DIFFERENT TYPES OF REINFORCEMENT.

Details of Crates tested.

Timber.—Norway spruce.

Nailing.—Two 5D c.c. nails into centre and ends of each batten.

Reinforcement.—Wire without tension 14 B.W.G. wires fastened around the centre and each end with one $\frac{3}{4}$ in. staple between battens.

Strapping without tension: $\frac{1}{2}$ in. flat nailed strapping fixed around the centre and each end with one 5D cement-coated nail per batten.

Strapping with tension: $\frac{1}{2}$ in. by 0.018 in. Acme flat strapping placed around the centre and each end and kept in position with four staples per strap.

Table 6.

Type of Reinforcement.	Number of Drops required to Spill Contents	Relative Strength to Wired Crate
Wire	101	1.00
Flat nailed strapping ..	129	1.28
Acme strapping	182	1.80

The tension type of nailless flat metal strapping was also studied as a suitable substitute for wire bindings (Table 6). Acme unannealed metal strapping was applied under tension over the nail-heads at the ends and centre, and kept in position by means of staples driven over the strapping into the battens. It proved the most effective type of end and centre reinforcement, crates fastened in this manner being considerably stronger than both the wired and nailed strapped packages. The failure in the three types of crates was substantially the same, the rate at which the various weaknesses developed being retarded in the case of the stronger containers. The ultimate failure was in all cases due to the breaking of one or more wire bindings, nailed strapping, or Acme nailless strapping.

Although applied under tension the nailless strapping requires to be held in position by staples, &c., otherwise the skewing of the crate and the tendency of the strapping between battens to catch and tear upon projections is apt to loosen the reinforcement, allowing it to slip off over the ends. Any size less than that used in the tests would give much poorer results.

Just as the nailed strapped crates were more difficult to open and close for weighing and inspection than the wired crates, so those reinforced with Acme nailless strapping were at a still greater disadvantage in this respect. Whereas the wire binding and nailed strapping may be used again after the opening of the crates, the Acme strapping must be replaced by new strappings.

COMPARISON OF DIFFERENT TYPES OF CRATE-CONSTRUCTION.

<i>Details of Crates tested.</i>				
	Standard.	Mat Type.	Cleated Type.	
Timber	N.Z. white-pine	Spruce ..	N.Z. white-pine.	
Nailing per batten ..	Two 5D c.c. ..	One 7D c.c.	Three 5D c.c.	
Number and thickness of battens ..	Twelve $\frac{3}{4}$ in. ..	Sixteen $\frac{1}{2}$ in.	Ten $\frac{3}{4}$ in.	
Reinforcement ..	14 B.W.G. wires	Gum hoops	$\frac{1}{2}$ in. by 0.018 in. straps.	
Ends	Single piece ..	Single piece	Two piece fastened with cleats.	

Table 7.

Type of Crate.	Number of Drops required to spill Contents.	Relative Strength to Standard Crate.
Standard	330	1.00
Cleated one-cheese	835	2.53
Cleated two-cheese	286	0.87
Mat-construction	93	0.28

Reference has already been made to the difficulty of opening and closing standard cheese-crates for weighing and inspection. Four per cent. of all crates are opened and closed, both in New Zealand and abroad, for the purpose of verifying weights, &c. This represents the opening and closing of one crate in every twelve; and since each crate so dealt with occupies a man's time on the average for fifteen minutes the difficulty is a very real one. Improving this feature of crate design will further reduce the original cost of assembly at the factory and enhance the value of the used crate.

Two types of crate thought to offer a solution of the difficulty were tested (Table 7). The mat type shown in Figs. 2 and 11 gave poor

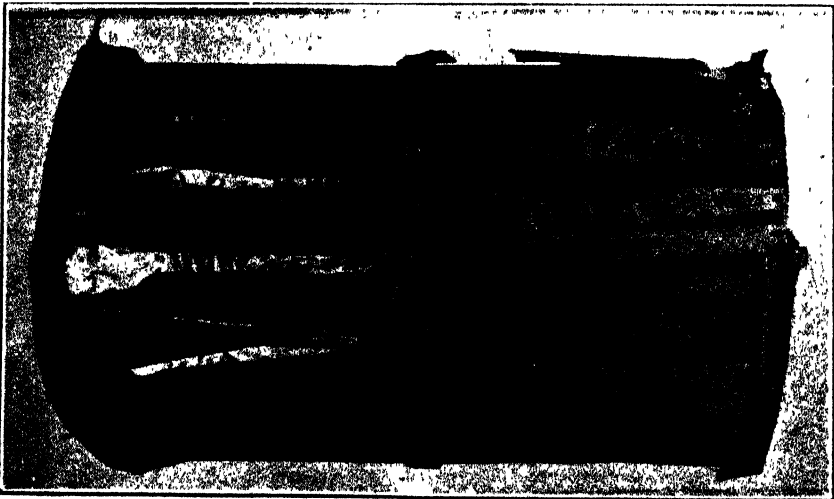


FIG. 11. TYPICAL FAILURE OF A MAT CRATE.

The gum hoops have first split, exposing the thin spruce battens, which then rapidly break.

results. These were not unexpected. The gum wooden hoops reinforcing the ends and centre were of insufficient strength, though they effectively protected the battens before they themselves split to pieces. The substitution of flat metal strapping for the wooden hoops would probably improve the package. It certainly has some promise for the export trade.

The cleated type of crate shown in Figs. 4, 5, and 12 gave results slightly lower than those displayed by the standard wired crate with cement-coated nails. It is, however, easier to assemble, and to open and close for inspection, and has, in addition, a higher salvage value than the wired crate. While it requires less timber for its manufacture, more nails are necessary. This disadvantage, however, is offset by the fact that no staples are used, and that only two Acme flat straps are used in place of the three wire bindings. This type of binding bends the battens in towards the cheese, and to prevent any possibility of their touching the produce the diameter of this crate is increased by $\frac{1}{4}$ in.

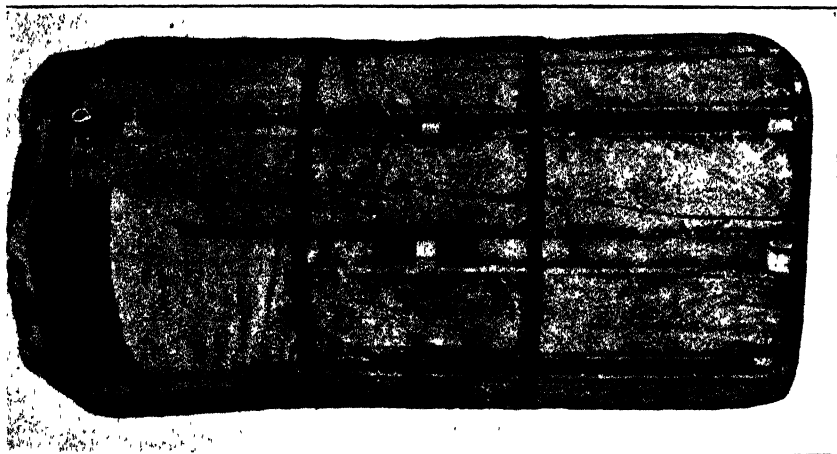


FIG. 12. TYPICAL FAILURE OF A CLEATED TWO-CHEESE CRATE

The majority of the battens have broken away from one end, allowing the end to almost break away from the crate

The method of failure was much the same as in the wired crates. It was noticeable, however, that the ends of the cleats absorbed a large portion of the stresses caused by the various drops in the machine. A study of cheese-crates in actual service was made in order to study a similar effect on the wired crates. A number of factories assemble their crates, having the ends of the battens about $\frac{1}{4}$ in. away from the edge of the ends, as shown in Fig. 13 *a*, instead of the usual practice as in Fig. 13 *b*. Accordingly, when a crate falls diagonally on to an edge, the end is often the first member of the crate to take the shock. In such cases there is a tendency for the nails in the end of the batten to compress the wood of the battens towards the centre, as in Fig. 13 *a'*. This weakness, however, is not as serious as that which develops in the crate of ordinary construction, in which the end of

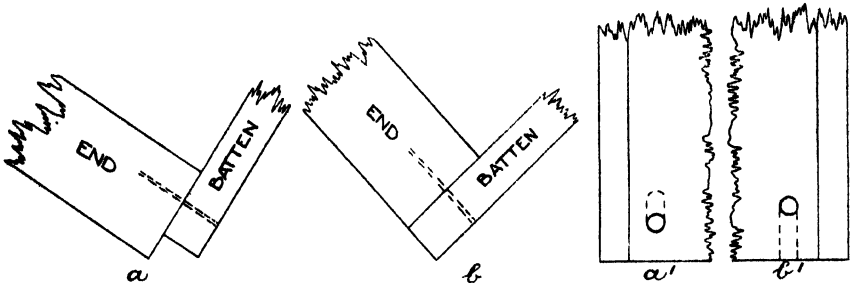


FIG. 13. SHOWING EFFECT OF DIFFERENT METHODS OF ATTACHING BATTENS TO ENDS OF CRATE.

(a) End of batten kept away from end of crate ; (b) end of batten flush with end of crate ; (a') after diagonal fall on to edge of crate the end is hit first, tending merely to loosen nail in batten ; (b') after diagonal fall batten hit first, tending to pull nail right through end of batten

the batten is the first member of the crate to take the shock in a fall diagonally on to an edge. Here the ends tend to pull the nail through the end of the batten, as in Fig. 13 *b'*.

Other things being equal, attaching the ends of battens away from the ends would appear to be the better practice. An examination

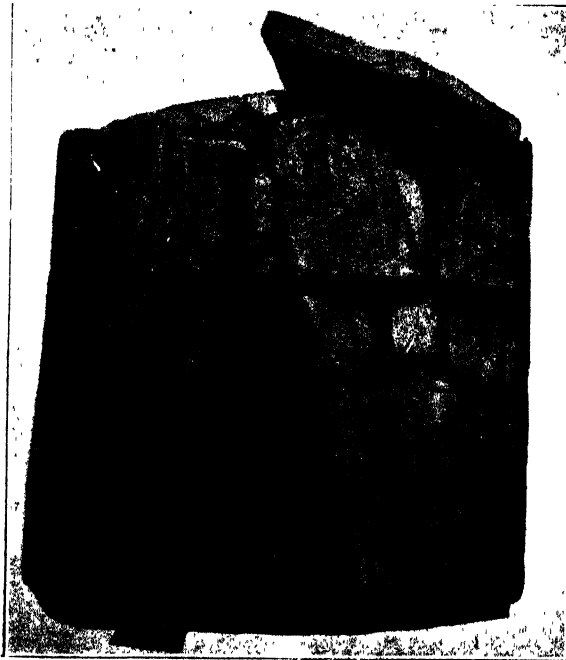


FIG. 14. TYPICAL FAILURE OF A CLEATED SINGLE-CHEESE CRATE.

The cleats and battens have pulled completely from one end, thus exposing the cheese.

of several hundred crates, however, indicated that with a smaller thickness of the end to nail into the nailing was decidedly poorer, there being a greater tendency to split battens and ends.

Some of the field studies of crates in actual service also suggested that the weight of the standard crates holding two cheeses, approximating to 175 lb., was too great for ease of handling. This did not obtain where mechanical handling equipment was in use. A series of tests was accordingly made, using a cleated type of crate holding only one 80 lb. cheese, as in Figs. 6 and 14. This proved to be the most serviceable and balanced crate tested, being approximately two and a half times as strong as the standard wired crate with cement-coated nails. It is admittedly slightly more expensive in comparison with the two-cheese size. This will probably militate against its adoption.

Whether the cleated type of crate is adaptable to export conditions is questionable. Crates awaiting export are at present piled on their ends. With cleated crates greater care would require to be taken in stacking. Piling on their sides, as in shipment by boat, would effectively remove this difficulty. At various ports, too, crates are moved on their ends along gravity conveyers. These would again require greater care in the handling of the cleated crate. The branding of the ends, although presenting some difficulty, is not by any means an insurmountable obstacle to the general adoption of the package.

EFFECT OF VARYING THICKNESS OF BATTENS.

Details of Crates tested

Size of Nails.— $\frac{1}{2}$ in. and $\frac{3}{8}$ in. battens: 5D cement-coated nails $\frac{7}{16}$ in. and $\frac{1}{2}$ in. battens: 7D cement-coated nails.

Number of Nails.—Ten-sided crates: Three nails into centre and ends of each batten. Twelve-sided crates: Two nails into centre and ends of each batten.

Reinforcement.—Standard crate: 14 B.W.G. wires fastened to centre and each end with one $\frac{3}{4}$ in. staple between battens. Cleated crate: Two $\frac{1}{2}$ in. Acme straps placed around crate 5 in. each side of centre.

Ends and Centre.—Standard crate: Single piece, $\frac{3}{4}$ in. thick. Cleated crate: Ends two-piece, $\frac{3}{4}$ in. thick, fastened together with two cleats, 2 in. by $\frac{3}{4}$ in., affixed with twelve 5D c.c. nails per cleat; centres fastened together with one dowel.

Table 8.

Thickness of Battens.	Timber.	Style of Crate.	Number of Battens.	Number of Drops required to spill Contents.	Relative Strength to Thin Battens.
$\frac{3}{8}$ in.	White-pine ..	Standard ..	12	330	1.00
$\frac{7}{16}$ in.	" ..	" ..	12	513	1.56
$\frac{1}{2}$ in.	" ..	" ..	12	623	1.89
$\frac{3}{8}$ in.	" ..	" ..	10	280	1.00
$\frac{1}{2}$ in.	" ..	" ..	10	545	1.95
$\frac{3}{8}$ in.	" ..	Cleated ..	12	193	1.00
$\frac{1}{2}$ in.	" ..	" ..	12	430	2.22
$\frac{1}{2}$ in.	Beech ..	Standard ..	12	265	1.00
$\frac{3}{8}$ in.	" ..	" ..	12	548	2.06

Throughout the foregoing series of tests constant reference has been made to the questionable thickness of battens used. As shown in Table 8 a comprehensive study was made of this feature of crate-construction, forty-five crates of different woods and different types being tested to destruction. The tests indicate that unless battens are supplied to a strict specification, $\frac{7}{8}$ in. material is very preferable to the $\frac{3}{4}$ in. material in common use. This applies only to white-pine, hemlock, spruce, and insignis pine. The silver-beech battens $\frac{3}{4}$ in. thick give a crate stronger than $\frac{7}{8}$ in. white-pine. Increasing the thickness of battens from $\frac{3}{4}$ in. to $\frac{1}{2}$ in., or 33 $\frac{1}{3}$ per cent., consistently resulted in a 100-per-cent. increase in the strength of the crates.

EFFECT OF ALTERING NUMBER OF BATTENS.

Details of Crates tested.

Timber.—New Zealand white-pine.

Size of Nails.— $\frac{3}{4}$ in. battens : 5D cement-coated nails. $\frac{1}{2}$ in. battens : 7D cement-coated nails.

Number of Nails.—Ten-sided crates. Three nails into centre and ends of each batten. Twelve-sided crates : Two nails into centre and ends of each batten.

Reinforcement.—Standard crate : 14 B.W.G. wires fastened to centre and each end with one $\frac{1}{4}$ in. staple between battens. Cleated crate : Two $\frac{1}{2}$ in. Acme straps placed around crate 5 in. each side of the centre.

Ends and Centres.—Standard crate : Single piece, $\frac{1}{2}$ in. thick. Cleated crate : Ends two-piece, $\frac{3}{4}$ in. thick, fastened together with two 2 in. by $\frac{3}{4}$ in. cleats, affixed with twelve 5D cement-coated nails per cleat ; centres fastened together with one dowel.

Table 9.

Style of Crate.	Number of Battens.	Thickness of Battens.	Number of Drops required to spill Contents.	Relative Strength to Twelve-sided Crate.
Standard	12	$\frac{3}{4}$ in.	330	1.00
.. .. .	10	$\frac{3}{4}$ in.	280	0.85
.. .. .	12	$\frac{1}{2}$ in.	623	1.00
.. .. .	10	$\frac{1}{2}$ in.	545	0.87
Cleated	12	$\frac{1}{2}$ in.	430	1.00
.. .. .	10	$\frac{1}{2}$ in.	635	1.48

In developing the cleated cheese-crates it was considered that greater strength might be obtained by decreasing the number of battens, thus reducing their tendency to break across the grain. The work was further extended to include the standard wired crates. In all, three sets comprising six different groups of crates were tested. In each set a reduction of battens from twelve to ten was made, the width of the battens in the latter case being increased by an amount sufficient to make the total air-space between battens the same in both the ten- and twelve-sided crates. The diameters of the ends and centres were kept constant in all cases.

The results are shown in Table 9. It was found with the standard wired crate that decreasing the number of battens as stated resulted in a 14-per-cent. decrease in the strength of the crate, due to the more frequent splitting of wider battens. With the cleated-style

crates, however, the opposite result occurred, the reduction in the number of battens resulting in a 48-per-cent. increase in the crate-strength. This was probably due to the method of reinforcement. The Acme straps, which are drawn very tightly around the crate, reduce the splitting tendency of the wide battens. The tendency of the battens to break across the grain, too, is reduced by increasing the width of the battens. A stronger crate is thus developed.

EFFECT OF INCREASING NUMBER OF NAILS.

Details of Crates tested.

Types of Crate.—Standard two-cheese crate and cleated one-cheese crate.

Reinforcement.—Standard type: 14 B.W.G. wires fastened to the centre and each end with one $\frac{3}{4}$ in. staple between battens. Cleated type: One $\frac{1}{2}$ in. Acme strap placed around centre of crate.

Ends.—Standard type: Single piece, $\frac{7}{8}$ in. thick. Cleated type: Two-piece, $\frac{1}{2}$ in. thick, fastened together with two 2 in. by $\frac{1}{2}$ in. cleats, affixed with twelve 5D cement-coated nails per cleat.

Number of Battens.—Standard type: Twelve. Cleated type: Ten.

Table 10.

Nails per Batten.	Type of Crate.	Timber.	Thickness of Battens.	Number of Drops required to spill Contents.	Relative Strength to Crates with fewer Nails.
One 5D c.c. . .	Standard..	Norway spruce	$\frac{3}{4}$ in.	96	1.00
Two 5D c.c. . .	" "	"	$\frac{3}{4}$ in.	101	1.05
One 7D s.w. . .	" "	"	$\frac{3}{4}$ in.	56	1.00
Two 7D s.w. . .	" "	"	$\frac{3}{4}$ in.	119	2.12
Two 7D c.c. . .	" "	White-pine	$\frac{1}{2}$ in.	623	1.00
Three 7D c.c. .	" "	"	$\frac{1}{2}$ in.	920	1.48
Two 5D c.c. . .	Cleated ..	"	$\frac{3}{4}$ in.	270	1.00
Three 5D c.c. .	" "	"	$\frac{3}{4}$ in.	835	3.09

During the course of the study various sets of tests were carried out on similarly constructed crates, with varying numbers of nails holding the battens to the centres and ends of the crates (Table 10). In all, comparative figures are available for four sets of tests, comprising in all eight groups of crates. As already indicated, nailing has a decided influence on the strength of cheese-crates.

With one set of spruce crates too small nails were employed, and in consequence the increased strength due to increased nailing was not marked. Using nails of a more suitable size, although of the smooth wire type, a further set of spruce crates developed a 100-per-cent. increase in strength for the use of two nails in place of one. Similarly, a 50-per-cent. increase in the nailing of a white-pine crate resulted in a 48-per-cent. increase in the strength of the crate. The most marked increase occurred in the cleated-type one-cheese crate. With this type a 50-per-cent. increase in nailing resulted in an increase of over 200 per cent. in the strength of the crate. This was due to the lower weight per nail ratio and the more balanced construction of this package.

Conclusions.

The results of the foregoing studies may be summarized as follows :—

(1.) The export crate as at present designed is an unbalanced container.

(2.) The use of cement-coated nails is essential if an economical and balanced package is to be designed.

(3.) A suitable-sized nail should be used for each species of wood—4D for silver-beech, 5D for white-pine, and 6D for insignis pine, hemlock, and spruce.

(4.) Silver-beech, white-pine, spruce, insignis pine, and hemlock rank in this order in suitability for cheese-crates where carrying-qualities are considered.

(5.) Flat strapping and wire binding applied with or without tension are both of great value as a reinforcement for crates.

(6.) Resistance to loss of contents increases with the number of bindings used.

(7.) Tension-applied nailless strapping, flat-nailed strapping, and wire binding rank in this order in strength as crate reinforcements.

(8.) The cleated and mat-construction crates offer possibilities for export service, and further experimental shipments should be forwarded abroad for study and comment.

(9.) Battens, $\frac{3}{8}$ in. thick, of white-pine, insignis pine, hemlock, and spruce are dangerously thin unless supplied under a rigid specification; otherwise a thickness of $\frac{1}{2}$ in. is recommended. Battens, $\frac{3}{8}$ in. thick, of silver-beech make a very strong crate.

(10.) A crate that could be opened and closed more readily for inspection purposes would be a decided advantage, and it is hoped later to evolve a design embodying this feature. The subject generally is by no means finalized at the present stage.

Recommendations for Standard Crate.

Having consideration to the various factors involved, the Forest Service recommends the use of *one standard type of crate for the export trade*. It can be manufactured from any of the timbers in use—beech, white-pine, insignis pine, hemlock, or spruce. It consists essentially of twelve-sided one-piece ends and centre, $\frac{7}{8}$ in. thick and 15 in. between parallel sides; battens, $27\frac{1}{2}$ in. long by 3 in. to $3\frac{1}{2}$ in. wide and not less than $\frac{3}{8}$ in. thick if constructed of white-pine, insignis pine, hemlock, or spruce, and not less than $\frac{5}{16}$ in. thick if manufactured of silver-beech; two cement-coated nails through ends and centres of battens; and an approved type of metal binding applied around each end and centre. This crate is much stronger than the present standard export package, and, further, is a more attractive container.

A detailed specification for this crate follows :—

SPECIFICATION FOR STANDARD METAL-BOUND CHEESE-CRATE FOR EXPORT.

Section A : General.

(1.) Definition: The crate as herein specified shall be known as the "Standard Metal-bound Cheese-crate—Export Type."

Section B : Timber.

(2) Woods used: The following timbers shall be admitted under this specification: White-pine (*Podocarpus dacrydioides*), silver-beech (*Nothofagus Menziesii*), insignis pine (*Pinus radiata*), western hemlock (*Tsuga heterophylla*), spruce (*Picea excelsa*), and other timbers approved by the Forest Service.

(3) Material: (a.) The battens and ends shall be well manufactured, and shall be cut true to size. All defects in the timber which materially lessen the strength of the part, or expose contents to damage, or interfere with proper nailing, shall be prohibited. (b.) The wood shall be thoroughly seasoned, and shall have a moisture content of not less than 12 per cent. nor more than 18 per cent., based on the weight of the wood after oven-drying to a constant weight.

(4) Dimensions: (a.) Battens shall be $27\frac{1}{2}$ in. long, not less than 3 in. nor more than $3\frac{1}{4}$ in. wide, and shall be not less than $\frac{3}{8}$ in. thick for white-pine, insignis pine, hemlock, and spruce boards, and not less than $\frac{1}{8}$ in. thick for silver-beech boards; the ends shall be twelve-sided, 15 in. wide between opposite sides, and $\frac{7}{8}$ in. thick. (b.) The variation in thickness of the boards above or below the thickness specified shall be not more than $\frac{1}{8}$ in., and this variation below the specified thickness shall not extend over more than 10 per cent. of the face of that particular board.

(5) Width of parts: (a.) Battens, ends, and centres shall be of single-piece material. (b.) Matched and glued or lock-jointed boards shall be regarded as single pieces. No end or centre shall consist of more than three boards so joined.

(6) Jointing: (a.) Matched and glued ends or centres shall in addition be fastened with not less than two galvanized corrugated fasteners, 1 in. by $\frac{3}{8}$ in. per joint. (b.) The edges of all battens shall be rounded or chamfered along their entire length on one side.

(7) Surfacing: The outside surface of the battens and tops may be fine-sawn or veneered finish; otherwise they shall be smooth-planed.

(8) The grain of the two ends shall be at right angles to one another, and the grain of the centre midway between the two.

Section C : Nailing.

(9) Nailing schedule: (a.) $1\frac{1}{2}$ in. cement-coated nails shall be used when driving into white-pine, $1\frac{1}{4}$ in. cement-coated nails when driving into insignis pine, hemlock, and spruce, and $1\frac{3}{8}$ in. cement-coated nails when driving into beech ends. (b.) Nails shall be driven flush. (c.) Each batten shall be attached to each end and centre by two nails.

Section D : Metal Binding.

(10.) Metal: (a.) Flat nailed strapping or stapled wire binding shall be of soft metal, and shall have a maximum tensile strength of approximately 50,000 lb. per square inch. (b.) Tension-applied nailless metal binding shall be of hard unannealed metal, and shall have a maximum tensile strength of approximately 84,000 lb. to the square inch. (c.) The binding shall be galvanized or otherwise treated to protect against rust.

(11.) The ends of tension-applied nailless bindings shall be fastened in such a manner that the joint shall have a breaking-strength of not less than 75 per cent. of the ultimate strength of the binding.

(12.) Size of binding: The metal binding shall be not less than $\frac{1}{2}$ in. in width by 0.018 in. thickness or of equivalent cross-sectional area.

(13.) Application: (a.) Three bindings shall be used per crate, placed around the ends and centre, and covering the nails driven through the battens into the ends and centre. (b.) Each nailed strapping shall be fastened to the crate with twelve nails, one nail being driven centrally through each batten. (c.) Each wire binding applied without tension shall be fastened to the crate with twelve staples, one staple being driven into the end or centre between all battens. (d.) Each tension-applied binding shall be kept in position on the crate with four staples per binding driven into the battens over the binding.

Acknowledgments.

The following organizations have co-operated with the Forest Service in the work here described: Dairy Division, Department of Agriculture—general; School of Engineering, Canterbury University College—crate tests; School of Engineering, Auckland University College—binding tests; Messrs. J. F. Hargreaves and Co. (Limited), Wellington, N.Z., Acme strapping and spruce crates; Messrs. Johnson, Clapman, and Morris (Limited), Wellington, N.Z., and United States Steel Products Company, New York—cement-coated nails; Messrs. J. B. MacEwan and Co., Wellington—hemlock crates; Hawera Co-operative Dairy Company—spruce crates; Messrs. P. Carey and Co., Auckland—mat crates; Mr. B. Hughes, Temuka—insignis-pine crates.

Special acknowledgment is due to the Madison Forest Products Laboratory of the United States Forest Service for its many reports upon box and crate construction. These have enabled the present work to be carried to a conclusion without the laborious investigation of many features of design already studied by the American laboratory.

A large number of the crate tests were carried out by Mr. E. H. A. Englebrecht, of the School of Engineering, Canterbury University College. To him special acknowledgment is due for his untiring work in this section of the study.

COMMON AND BOTANICAL NAMES OF TIMBERS MENTIONED IN THIS ARTICLE.

Common Name.	Botanical Name.	Country of Growth.
White-pine	.. <i>Podocarpus dactyloides</i> ..	New Zealand.
Insignis pine	.. <i>Pinus radiata</i> "
Silver-beech	.. <i>Nothofagus Menziesii</i> "
Norway spruce	.. <i>Picea excelsa</i> ..	.. Scandinavia.
Sitka spruce	.. <i>Picea sitchensis</i> ..	.. Pacific Coast of North America.
Hemlock ..	.. <i>Tsuga heterophylla</i> ..	.. Pacific Coast of North America.
Gum ..	.. <i>Liquidambar styraciflua</i> ..	.. North America.

Paper Method of Weed-control.—In tree nurseries of the State Forest Service last year trials were initiated with Pabco-Thermogen paper mulch as a weed-reducer. Results were, on the whole, unsatisfactory (states the annual report of the Service); in most cases the efficacy of the mulch in smothering weeds was lost by the impossibility of fixing the paper so as to adhere closely to the ground. The effect of the mulch on plant-growth varied—in one case seedlings touching the paper appeared to be "burnt," while better plant-growth was observed in some lines treated with mulch. Generally speaking, however, no great difference in growth was found. Soil analysis made showed that no "souring" of the soil was produced by the application of the mulch in the lines.

Pasteurizing Milk for Cheesemaking.—During the dairying season of 1925-26 the quantity of cheese made in factories equipped with pasteurizing plants equalled 76 per cent. of the total output of the Dominion, as against 69 per cent. for the preceding season.

Correction.—In the C.O.R. list published in the *Journal* for November last the mature Jersey cow Woodlands Gipsy, with a record of 651.41 lb. butterfat, was inadvertently entered as tested by J. G. Morgan, Ngawapurua. This should have been S. G. Morgan, Woodville.

TESTING OF PUREBRED DAIRY COWS.

DECEMBER CERTIFICATE-OF-RECORD LIST.

Dairy Division.

THE appended list gives details of performance of cows which received certificates during December, 1926. It will be noted that several specially good records among the several breeds are included, although no changes in class-leaderships have been made.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

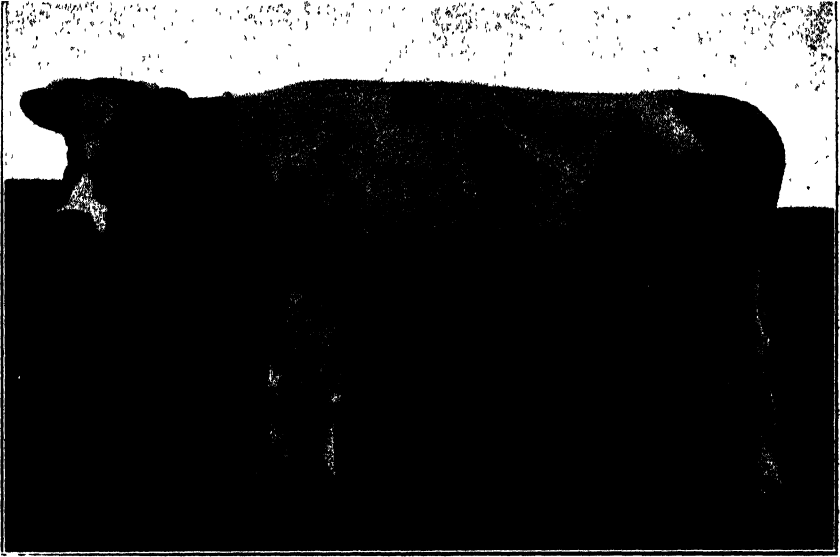
Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS.						
		Yrs.	dys.	lb.	lb.	lb.
<i>Junior Two-year-old.</i>						
Croydon Princess May	W. Crosby, Waipuku ..	1	355	240·5	365	9,213·0
Pencarrow Carnation	R. S. Tuck, Waharoa ..	2	35	244·0	365	11,185·4
Falconite Pansy*	G. E. Yelchich, Waiuku ..	2	64	246·9	365	10,094·2
Merivale Hope ..	A. R. Gudopp, New Plymouth	2	18	242·3	365	8,460·5
Lucifera ..	Mrs. A. Banks and Son, Kiwitea	1	267	240·5	365	9,460·8
Woodstock Bracelet	Mrs. A. Banks and Son, Kiwitea	1	340	240·5	365	8,833·2
Silverstream Tui ..	G. B. Hull, Silverstream ..	2	1	240·6	352	8,533·3
Alfalfa Magnet ..	R. S. Tuck, Waharoa ..	1	351	240·5	365	8,358·15
Oxford Lily ..	R. S. Tuck, Waharoa ..	1	343	240·5	365	8,668·7
Woodstock Jenny ..	Mrs. A. Banks and Son, Kiwitea	2	13	241·8	365	9,806·0
Silverstream Erica ..	G. B. Hull, Silverstream ..	1	343	240·5	364	7,457·2
Merrie Meade Nocturne	H. C. Grierson, Papatoetoe	2	17	242·2	365	8,910·9
Glenavon Heroine ..	J. Townsend, Puni ..	2	64	246·9	328	9,547·8
Coniston Gazelle ..	R. Waterhouse, Papakura	1	225	240·5	365	6,558·2
Ngahiwi Eminent Treasure	W. J. Freeth, Waitara ..	1	332	240·5	365	7,066·7
Middlewood Rosary	Kilgour Sisters, Kiwitea ..	1	344	240·5	365	6,752·7
Woodstock Hopeful	Mrs. A. Banks and Son, Kiwitea	2	22	242·7	365	7,137·9
Te Aute Thistle ..	W. T. Williams, Pukehou	1	292	240·5	363	6,960·8
Collingwood Perfection	Hellyer Estate, Dunedin ..	2	65	247·0	302	7,714·6
Almadale Jewel ..	R. S. Tuck, Waharoa ..	1	363	240·5	365	6,856·3
Lady Buttercup ..	J. Quinn, Drury ..	1	351	240·5	365	6,736·2
Ladybird's Pauline ..	R. E. Clements, Dargaville	2	32	243·7	365	5,196·2
Mountain View Mermaid	A. Hamlin, Tangiteroria ..	2	61	246·6	365	8,131·8
Goldfield's Nancy ..	W. Muir, Waihi ..	2	36	243·1	365	5,900·4
Cloverlea Eunice ..	D. P. F. Malone, Kaponga	2	27	243·2	285	5,838·2
Merrie Meade La Paloma	H. C. Grierson, Papatoetoe	1	362	240·5	365	6,377·4
Oaklands Lenora ..	G. W. Ryall, Aria ..	1	322	240·5	282	4,927·1
Holly Oak Raven	J. R. McDonald, Levin ..	1	332	240·5	303	5,138·8
Lady						
Besses Golden Maize Bud	H. Stonex, Bell Block ..	2	72	247·7	223	4,295·7

LIST OF RECORDS—*continued.*

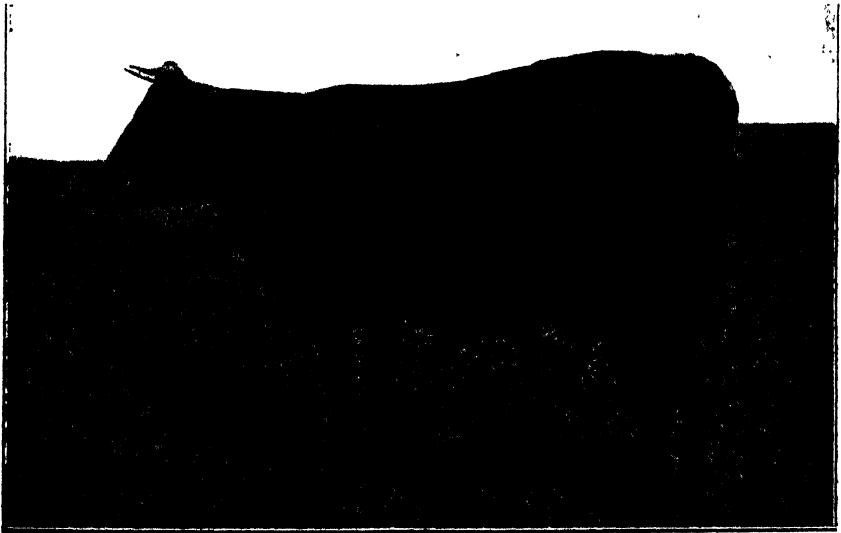
Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS—<i>continued.</i>						
<i>Senior Two-year-old.</i>		Yrs. dys.	lb.		lb.	lb.
Woodstock Finality ..	Mrs. A. Banks and Son, Kiwitea	2 322	272·7	365	10,380·6	612·57
Holly Oak Primulet ..	Kilgour Sisters, Kiwitea ..	2 221	262·6	365	10,105·8	575·65
Cowslip's Gem ..	W. T. Williams, Pukehou ..	2 332	273·7	359	9,631·3	535·95
Pukatere ..	F. S. McRae, Palmerston N.	2 169	257·4	365	8,181·6	523·71
Thelma's Joy ..	Kilgour Sisters, Kiwitea ..	2 356	276·1	365	8,360·8	462·62
Oakland's Grizotte ..	W. J. Chynoweth, Hamilton	2 357	276·2	227	4,820·2	279·59
<i>Three-year-old.</i>						
Woodstock Féerie ..	A. E. Watkin, Takanini ..	3 298	306·8	365	12,865·3	627·12
Woodstock Suzanne	Mrs. A. Banks and Son, Kiwitea	3 231	300·1	365	10,348·8	546·77
Orange Dale Pearl ..	J. T. Warman, Katikati ..	3 364	313·4	360	8,467·1	468·06
H.M.S. Marvel ..	W. Devine, Palmerston N.	3 85	285·5	329	6,836·3	324·01
<i>Four-year-old.</i>						
Elf's La Primavera ..	John Robb, Westmere ..	4 62	319·7	365	9,583·4	586·77
Conqueror's Bright Star	H. R. Benbow, Ormondville	4 58	319·3	358	8,127·0	469·10
Silverstream Choice Fox	G. B. Hull, Silverstream ..	4 80	321·5	344	9,942·2	452·89
<i>Mature.</i>						
Tikitere ..	F. S. McRae, Palmerston N.	8 114	350·0	363	12,054·2	746·94
Waipiko Joletta ..	C. G. C. Dermer, Waipiko	6 358	350·0	365	13,537·8	724·21
Rose's Sun Queen ..	John Hale, New Plymouth	7 40	350·0	365	11,870·2	638·37
Flighty Genoa Girl ..	W. Robinson, Patumahoe ..	5 20	350·0	365	13,150·6	623·19
Silver Dot ..	J. Quinn, Drury ..	10 335	350·0	365	10,355·2	608·71
Fair View Cherry ..	J. Klenner, Kaimata ..	7 255	350·0	365	11,166·8	599·89
Waipiko Cuddle ..	C. G. C. Dermer, Waipiko	5 280	350·0	365	10,503·8	586·93
Miro Meadows Myrtle Leaf	A. A. Ward, Tariki ..	5 282	350·0	365	9,782·5	570·05
Wotton Sandaisy ..	H. J. Lancaster, Glen Oroua	6 121	350·0	365	10,478·6	563·05
Rockview Lady ..	G. R. and H. Hutchinson, Auckland	5 25	350·0	364	10,883·3	561·37
Holly Oak's Lala ..	F. Jennings, Mauriceville	6 102	350·0	319	10,374·1	519·53
Oakvale's Janette ..	W. J. Freeth, Waitara ..	7 307	350·0	365	8,981·7	516·49
Silverdale Victoria ..	H. R. Snell, Ngunguru ..	6 186	350·0	365	8,112·4	430·01
Fox's Golden Pet ..	J. H. Sherrard, Otatau ..	5 6	350·0	344	6,002·6	355·78
FRIESIANS.						
<i>Junior Two-year-old.</i>						
Na Riwi Mercena* ..	H. W. Reeve, Waitoa ..	2 84	248·9	365	16,945·2	685·50
Ohio Sensation* ..	C. H. Potter, Pukerau ..	1 309	240·5	365	16,560·2	564·84
Melrose Sylvia Echo Lassie*	T. Sheriff, Clandeboye ..	1 331	240·5	365	15,867·7	542·25
Ohapi Korndyke Colanatha*	Muff Bros., Orari ..	2 173	257·8	365	12,944·8	407·93
Ohapi Korndyke Queen Posch*	Muff Bros., Orari ..	2 3	240·8	338	11,711·8	404·62
Dominion Chloe Beets	Central Development Farm, Weraroa	1 312	240·5	365	10,356·0	354·54
<i>Senior Three-year-old.</i>						
Ryvington Pontiac Stately†	Mrs. A. M. Hodgson, Tamahere	3 354	312·4	365	13,321·3	481·29



BAINFIELD SYLVIA TOPSY 4TH (MICKELL BROS., TE HORO).

C.O.R. in Friesian senior three-year-old class: 17,540 lb. milk, 804.73 lb. butterfat.



MATANGI RUTH 3RD (RANSTEAD BROS., MATANGI).

C.O.R. in Milking Shorthorn senior three-year-old class: 13,954.6 lb. milk, 688.75 lb. butterfat.

LIST OF RECORDS—continued.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat rec'd for Cent.	Yield for Season.		
				Days.	Milk.	Fat.

MILKING SHORTHORNS.

<i>Two-year-old.</i>			Yrs. dys.	lb.		lb.	lb.
Fine Farm Jewel 6th	J. Parkinson, Opotiki ..	2	58	246·3	307	9,683·4	359·99
<i>Senior Three-year-old.</i>							
Matangi Ruth 3rd†	Ranstead Bros., Matangi ..	3	333	310·3	365	13,954·6	688·75
<i>Four-year-old.</i>							
Mereside Gem†	W. Bowis, Doyleston ..	4	4	313·9	361	10,142·8	402·19
<i>Mature.</i>							
Sunnyside Pro u d e	R. A. Anderson, Invercargill	5	27	350·0	365	12,227·35	495·90
Princess							
Dominion Jealousy of Ruakura	R. A. Anderson, Invercargill	6	49	350·0	285	8,932·1	354·42

AYRSHIRES.

<i>Two-year-old.</i>							
Glengyle Mountain Maid	McAdam Bros., Queenstown	2	23	242·8	365	7,380·2	319·57
Glengyle Mountain Fairy	McAdam Bros., Queenstown	2	46	245·1	365	5,938·2	253·10
<i>Three-year-old.</i>							
Glengyle Mountain Daisy	McAdam Bros., Queenstown	3	10	278·0	333	7,897·7	371·73
<i>Four-year-old.</i>							
Ivanhoe Hindsward Jean	McAdam Bros., Queenstown	4	357	349·2	365	11,137·8	379·25
<i>Mature.</i>							
Greenfields Brown Stately	Webb Bros., Levin ..	5	356	350·0	365	16,110·3	586·28
Greenfields Marion ..	Webb Bros., Levin ..	5	5	350·0	365	13,413·9	515·41
Alice II of Inglewood	Allan Bros., Lower Shotover	13	312	350·0	330	10,301·8	418·56
Ivanhoe Dewdrop ..	McAdam Bros., Queenstown	5	271	350·0	352	10,966·3	402·19

RED POLLS.

<i>Two-year-old.</i>							
Dominion Miss Cavell	Central Development Farm, Werarua	2	54	245·9	365	7,785·6	357·30

Second-class Certificates.

Jerseys.

<i>Junior Two-year-old.</i>							
Holly Oak Comedy Lass	F. Phillips, Otorohanga ..	1	282	240·5	365	7,440·3	405·63
Tolgarth Pretty Nice	W. T. Williams, Pukehou	1	267	240·5	365	5,844·7	353·17
<i>Senior Two-year-old.</i>							
Kaimata Duchess ..	J. Klenner, Kaimata ..	2	362	276·7	365	9,736·6	472·42
<i>Mature.</i>							
Snow View's Mermaid	A. J. Miller, Uruti ..	6	262	350·0	314	9,206·0	440·87

SEASONAL NOTES.

THE FARM.

TILLAGE OPERATIONS.

THE preparation of land for autumn sowing of grass and for catch-cropping—as dealt with in last month's notes—may be continued during February. When selecting the area to be sown down to grass one should avoid, if possible, land which has just produced a grain crop. This is of particular importance in parts of Canterbury this season, where the ravage of the grass-grub in the wheat crops has been evident. It is best to follow up with grass after some fed-off crop such as rape. Where cereals are to be autumn-sown in grain-growing districts the land selected—either stubble or lea—should be skim-ploughed as early as possible.

The intercultivation of root crops should be continued unless the crop is too far advanced and it is impossible to get through without damage. An extra cultivation often means all the difference between a light yield and a heavy crop of roots. Potatoes will receive their final intercultivation, but if large-growing weeds tend to get away in the crop after this operation is finished it will be advisable to remove them as far as possible by hand. Keep the team busy on summer-fallowed land; it will take all the sunshine available to kill out any twitch.

SOWING OF SECONDARY BURNS

Should favourable weather conditions prevail during the next few weeks occupiers of unploughable bush land will have a chance to clean areas that have reverted to fern and second growth. Indiscriminate patch-burning is not to be recommended, but if a little money can be spent much can be done in a dry autumn. Where the fern is not too thick, and there is still a fair proportion of grass existing, top-dressing may be all that is required, provided that the grazing can be effectively controlled. Land that has completely reverted, however, must be resown as well as top-dressed.

Bracken fern is not difficult to burn, provided a suitable wind is utilized, but hard fern should only be burnt in a really dry season, otherwise the roots will not be completely destroyed and a ring of fresh growth will spring up. Water-fern is the hardest of all to burn, and is best checked by logging-up, coupled with top-dressing and heavy stocking with cattle. Wineberry is best cut in December and January, and manuka a little earlier.

Heavy sowing is not necessary for successful regrassing—in fact, it is a waste of money to spend much on seed of the better grasses which have already shown that they find the conditions too severe. Cocksfoot in particular is most unsatisfactory for resowing, though a certain number of suppressed plants will survive the fire and show up when the manure takes effect. Rye-grass should be used only to throw early feed. Experience has shown that brown-top and crested dogstail are two of the best species for this work. *Danthonia* should be included in nearly all cases, also *paspalum* in localities within

its successful range. *Paspalum*, however, should not be sown after the first week in March.

A good general mixture would be as follows: Perennial rye-grass, 7 lb.; crested dogtail, 2 lb.; brown-top, $1\frac{1}{2}$ lb.; *Danthonia pilosa*, 2 lb.; *Lotus major*, $\frac{1}{2}$ lb.; Colonial white clover, 1 lb.; suckling-clover, $\frac{1}{2}$ lb.; subterranean clover, $\frac{1}{2}$ lb.: total, 15 lb. per acre. On the better classes of land a little *Poa pratensis* and cocksfoot may be added; in shady situations the brown-top and *Lotus major* should be increased at the expense of the *danthonia* and dogtail. The cost of the mixture specified at current prices is about £1 2s. per acre.

Manure should always be applied after the seed if possible, even if for financial reasons the dressing is a light one. Reversion to fern and second growth is a sign of depletion of fertility in the surface soil, and the ash of the burn is insufficient to make good this deficiency. Hence the young grass must be helped if it is to compete successfully with the fern. Super is generally the best for the purpose, though it is as well to add a little lime.

BREAKING IN VIRGIN FERN COUNTRY.

There are-- in Auckland Province especially--many thousands of acres of ploughable fern land still awaiting reclamation. The soil of these Auckland areas consists for the most part of a friable loam of a semi-volcanic or pumiceous nature. Where this soil is of a fair depth, as is usually indicated by the vigour of the fern, it can be brought into productivity at a moderate cost, provided that the settler is prepared to use the right methods and to undertake no greater acreage than he can manure regularly.

It is a mistake to attempt the immediate conversion of this land to permanent pasture, either by surface-sowing or by ploughing. It first requires sweetening, fertilizing, and consolidating. This is best done by means of temporary pastures consisting mainly of clover and helped by generous top-dressing. About February the standing fern should be burnt and the land disked thoroughly. Disking is better than ploughing, because it does not bring up raw soil, and it leaves the land fairly solid.

After the harrows have been used to level off the surface, sowing should be done with a mixture approximating to the following: Italian rye-grass, 10 lb.; perennial rye-grass, 8 lb.; cow-grass, 5 lb.; white clover, 1 lb.; English trefoil, $\frac{1}{2}$ lb.; subterranean clover, $\frac{1}{2}$ lb.; soft turnips, $\frac{1}{2}$ lb.: total, $25\frac{1}{2}$ lb. per acre (costing about £1 per acre). If possible the land should be rolled before sowing, otherwise the necessary consolidation may be obtained with sheep. The following manure is suitable for application with the seed: Super, 2 cwt.; bonedust, $\frac{1}{2}$ cwt.; lime, 1 cwt., per acre. Subsequently the land should be top-dressed regularly, preferably with super and lime. The feed so obtained will hardly be first-class dairying pasture, but it will be both early and abundant. As far as possible it should be stocked with heavy cattle in order to obtain as much consolidation as possible.

At the end of two or three years this temporary pasture will begin to open out at the bottom. It should then be ploughed and resown with a permanent mixture after one or possibly two crops of turnips have been taken.

LUCERNE.

February and the early part of March is a good time for cleaning up and renovating lucerne stands, as the fine weather then usually prevailing enables the destruction of grass, weeds, &c. The work is best carried out by means of a cultivator fitted with proper lucerne teeth. If the land has set hard or the field is badly infested with grass it may be necessary to go over it once or twice with disks set almost straight to break the surface and cut the sods, and follow this with the cultivator. If the land is extremely hard it is better to wait until there has been sufficient rain to soften the surface.

Young lucerne crops sown in December should be ready for their first cut about the middle of February. It is very important that this cut be delayed as long as possible, and unless the stand is being smothered with weeds it should be deferred until the new growth is coming away strongly from the crowns. About this time a large proportion of the plants should be showing flowers. Immediately after this cut the area should be given a light cultivation, either with the tine harrows or a very light cultivator, to loosen the surface of the land.

In Marlborough many lucerne and clover stands are cut for seed in February. Material should be thoroughly dry before being stacked—much drier than for hay. In a season like the present one much better seed will be obtained by keeping the stuff in stack for a month or more before shelling than by shelling out of the paddock or immediately after stacking.

— *Fields Division.*

THE ORCHARD.

SPRAYING.

THE current period's spraying for the control of codlin-moth is a necessary spray, and should not be omitted by growers. All infected fruits should be gathered and immediately destroyed. Where powdery mildew is in evidence the trees should again be thoroughly sprayed with precipitated sulphur (10 lb. to 12 lb. per 100 gallons). An examination of the trees should be made for red mite and apple-leaf-hopper infection, and where either of these pests is discovered a control spray should be applied to kill the insects before they have an opportunity of laying overwintering eggs. Where black-spot of apple and pear has been troublesome, a close inspection of the fruit and foliage should now be regularly made until the fruit is gathered, in order to detect the infection when it first appears. The first evidence of the disease should be regarded as the danger-signal, and, where conditions permit, the infected varieties should be sprayed immediately to prevent infection or blemish. Brown-rot-infected fruits and mummies should be carefully gathered and destroyed, as the mummies are a source by which brown-rot infection is carried over to subsequent seasons.

Detailed advice as to the sprays to apply will be found in the September *Journal* notes.

SPRAY RESIDUE.

In connection with spraying, prospective shippers will have to consider the matter of spray residue on fruit intended for export. It is very necessary to avoid having an excess of residue on the fruit, and to this end growers are advised to carefully consider the sprays and their ingredients which they intend to apply at the last spraying prior to picking. It is advisable in this respect to omit the spreader, to avoid any excess of lime which it has been the custom to add to any mixture, and to omit Black Leaf 40 from the lime-sulphur and arsenate-of-lead combination. Growers who have had occasion to wipe the residue from their fruit before wrapping will appreciate the benefit to be obtained by eliminating or reducing from late sprays the quantity of certain ingredients which usually cause an objectionable marking or stain.

CULTIVATION.

Cultivation should be continued during the present month in order to destroy weeds and to stir the soil, also to conserve the soil-moisture, as the trees are usually in most need of moisture at this period in the growth of the fruit. In working the ground it is important that the implement used should not go so deeply into the soil as to disturb the fine white root-hairs through which the trees feed, or to expose them to the sun and the atmosphere.

COVER-CROPS.

An important matter in connection with the management of the orchard at this period of the year is the sowing of a cover-crop. In many of our soils it has been demonstrated that the addition of organic matter is very beneficial. Amongst the benefits to be derived from the use of cover-crops are the following: (1) Improvement of the physical condition of the soil and subsoil; (2) addition of organic matter to soil; (3) leguminous crops add nitrogen to the soil; (4) cover-crops in general use up soluble plant-foods, and thus prevent their loss by being washed out by autumn and winter rains; (5) they tend to cause fruit and growth to ripen earlier than is the case where cover-crops are not used; (6) they prevent erosion on steep slopes. The most satisfactory and cheapest method of supplying humus to the soil is by growing such green crops as blue lupins (40 lb. to 50 lb. per acre); oats and vetches (oats $1\frac{1}{2}$ bushels, vetches 1 bushel, per acre); Canadian field-peas (60 lb. per acre); mustard (sown broadcast, 6 lb. to 8 lb. per acre); Cape barley (1 bushel per acre).

In considering the crop to be sown it should be remembered that such leguminous crops as lupins, peas, and vetches supply in addition to organic matter a considerable amount of nitrogen. To obtain the maximum results it is advisable to sow a fertilizer with the crop—say, superphosphate at the rate of 2 cwt. per acre.

BUDDING.

The latter part of January and early February is a good time for doing this work. Select the buds from well-developed shoots of the present season's growth, and from trees which have borne regularly good crops of fruit of the best quality. Where old trees are being reworked buds should be inserted on the outer side of the stock to

be worked, as this will result in a more open head and a better-shaped tree than if worked on the inner side of the shoots. Details as to budding were given in last month's notes.

PICKING.

The picking of the fruit was dealt with in the November *Journal* notes to some extent. In picking all kinds of fruit it is important that it should be perfectly dry, especially if it is intended to store it for some time. Picking should not be commenced in the morning until the dew has left the fruit. The harvesting of the apple and pear crop will now have begun. Apples should be gathered immediately they become ripe—but not fully ripe. When left too long on the trees they are apt after a period of storage to become mealy and lose flavour. The period for which fully ripe fruit may be held for market purposes is very short. If picked too soon the fruit will be poor in quality and flavour, and will wilt and shrivel in storage. Late varieties of apples are usually picked when fully mature and when the deep-green ground colour is assuming a yellowish tone. As these varieties ripen slowly, several months usually elapse before they are eating-ripe.

The proper degree of maturity may be gauged in various ways, and it is not advisable to rely solely on any one of the following indications of ripeness when determining whether the fruit is ready to pick: (1) The fruits should have the necessary amount of red colour usually associated with the variety, and according to the position of the fruit on the tree; (2) distinct change of ground colour towards light yellow—the hard green colour should have gone; (3) ease with which stem parts from the spur. Some pickers rely mainly on the good brown colour of the seeds as an indication of ripeness, but this way is unreliable for some varieties. Sturmer, for instance, is under certain conditions still immature when the pips are quite brown. Apples should be picked with stems intact.

Pears are somewhat peculiar in their manner of ripening, and to develop the best quality the fruit should be gathered when it is green but matured. If left to become too ripe on the trees some varieties develop gritty granules in the flesh, while others rot at the core and generally do not develop the luscious and finest flavours possessed by fruits gathered from the tree before they are ripe. Pears should also be picked with stems intact.

Quinces should be fully ripe before they are gathered.

Care should be taken not to break off more fruit-spurs than can possibly be avoided, as the spurs are required for the production of subsequent crops. Pickers should be instructed to place the thumb beside the joint between the stem of the fruit and the spur and then bend the fruit sharply towards the thumb; if the fruit is sufficiently mature the stem will readily part from the spur. Fruit damaged through the pulling-out of the stem soon commences to decay. Fruit generally does not ripen evenly on the individual trees, and to obtain the best results three or four pickings should be made. The smaller fruit and that low down on the tree should generally be gathered at the last picking. It is well to remember that there is a considerable variation in the ripening of the different varieties and of the same varieties under different conditions, and to obtain the best results a careful study should be made by growers.

EXPORT OF FRUIT.

It is important and in the best interests of every grower that only the best fruit should be sent away. The fruit should neither be too green nor too ripe. The best time generally to pick for export is when the dark-green ground colour changes towards a light yellow, and when the stem will part from the spur. The fruit should be well graded as to colour, size, and blemish. The wrapping, labelling, and stamping should be neatly done, and the cases packed full and sufficiently tight to prevent looseness developing in the handling and storage. Much damage is occasioned to fruit through very tight packing. Every care should be used to prevent bruising. Throughout all the handlings the fruit receives, everything possible should be done to cause it to open up in such condition that it will more than favourably compare with the fruit of our competitors on the markets of the United Kingdom and elsewhere.

FRUIT FOR IDENTIFICATION.

From time to time specimens of fruit are submitted for naming without any description of the habit or growth of the trees, or any particulars whatever. It is advisable that the specimens should be accompanied by a description of the tree, when the fruit ripens, the name (if any) by which it is locally known, and any other information which would be of assistance in determining the proper name. At least three typical specimens, with stems attached, should be forwarded.

—*W. K. Dallas, Orchard Instructor, Dunedin.*

Citrus-culture.

Continued cultivation will still be the main work in the citrus grove. With the heavy rainfall experienced this season root-action near the surface will be very pronounced, and unless the land is constantly cultivated the surface soil may become a mass of roots which will be badly parched during the drier season to come. With the surface soil well tilled, however, roots will be maintained at a level where more equable moisture may be expected. Should dry weather set in some mulch will be required. Stable manure is to be preferred, but hay, straw, or any available litter will serve the purpose. Take care not to pile any material round the trunk of the tree, as bark-injury may be caused by such contact.

The rapid growth made this season under very humid conditions will result in wood-growth of a very soft nature and in excess of the amount required to properly build or furnish the tree. Much benefit will be derived from the suppression of undesirable growth, in order that the wood really required may be better matured and more stable.

Humid conditions suitable for the spread of verrucosis and grey scab will necessitate a further spray of bordeaux, 3-4-40, if the advancing crop is to be maintained clean.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

CARE OF THE YOUNG STOCK.

FEBRUARY can generally be regarded as a comparatively easy month on the poultry plant, nevertheless there are several important matters that demand close attention. Perhaps the most important is to see that the pullets are specially cared for, in order that they may produce their maximum egg-yield when high prices rule for this product at a later date. It is a mistake to conclude that because the young birds have passed the brooder stage they can be left to scratch for their living and generally look after themselves. They are now just as apt to get a setback—which will never be caught up—as at any stage of their development.

Only good sound grain foods should be fed—as much as the birds can eat at each meal without waste. Good short plump oats are an excellent food for growing birds, and when available should be included in the ration. It has the effect of keeping them steadily growing, while it tends to prevent the pullets from attaining maturity at too early an age. Green food, such as silver-beet, cabbage, rape, or finely chaffed succulent grass, clover, lucerne, &c., should be fed in abundance, while grit and charcoal should always be in reach of the birds to pick at. Do not fail to keep the drinking-fountains clean and regularly filled. Any neglect in this direction, and especially at this season of the year, will have an injurious effect on the birds.

Keep the quarters clean—the secret of preventing vermin making their appearance—remembering at all times that young stock in particular cannot be satisfactorily developed if compelled to sleep in dirty or lice-infested quarters. Where possible give the growing birds a good range, as confined or hothouse conditions do not tend to promote the development of healthy and robust stock. Of course, reference is now made only to the young pullets and cockerels intended for future breeding purposes. Cockerels intended for the table should have their exercise curtailed, as a free range does not tend towards rapid flesh-formation. Above all things, see that the accommodation is not overtaxed, as crowded stock can never give a good account of themselves. Clean, roomy quarters and a good range, together with liberal feeding, are among the chief essentials in developing young stock.

THE IMPORTANCE OF GRIT.

If fowls are to be maintained in a healthy productive condition it is essential that they be provided with an unlimited supply of grit. It is not generally realized that the lack of grit not only means a reduced egg-yield, but is also a frequent cause of liver troubles, crop disorders, indigestion, and consequent disorganization of the system. The chief function of grit is to assist digestion. It must be remembered that fowls have no teeth to masticate their food. This process is performed in the gizzard by muscular action and a grinding process, the food being ground between the grit swallowed by the bird and the walls of the gizzard. Thus, the harder and sharper the grit the better will it assist the grinding process. No matter how hard and sharp

grit may be, the grinding action of the gizzard will soon have the effect of wearing it down. This indicates that the bird should always have the opportunity of replacing the worn stones by those that are sharp. Some people supply their fowls with round water-worn pebbles as grit, but these are unsuitable for the purpose, unless, of course, they are first put through a grit-mill and broken up. Where fowls have a free range and the ground is of a gravelly nature they will in most cases pick at all the grit they require, but on heavy clay soil, even although they have their liberty, grit should be provided. On the farm where, say, one hundred birds are kept on free range, it is surprising how soon they will consume a drayload of gravel, providing it has been sieved and is of a suitable size for the birds to swallow. In addition to sharp gravel grit, broken sea-shell should be always available for the birds to pick at as an egg-shell-forming material. It is not generally realized that egg-eating and the production of shell-less eggs are frequently caused by the fowls being provided with insufficient lime for the manufacture of shell. It should always be remembered that a hen when laying will eat double the amount of oyster-shell than when not laying.

PROTRUSION OF THE OVIDUCT.

Many complaints have reached me of fowls being affected with protrusion of the oviduct. In one case over twenty birds were lost from this cause in one week. The trouble is usually due to over-feeding with rich foods such as meat, meat-meal, &c. Providing the birds with a large quantity of milk to drink is also often responsible for ovarian disorder. Where the danger lies in this respect is in compelling the laying bird to drink a large quantity of milk merely for the purpose of quenching its thirst. Especially is this the case during hot weather. In addition to the milk, water should always be available, so that the bird is not forced, in order to secure a drink, to take more of the latter than is good for it. Where milk is provided in large quantities to drink, the risk of ovarian troubles and the production of shell-less eggs will be minimized if water is provided in a separate receptacle.

Another trouble, which is often confused with an ovarian disorder, is caused by a hen picking at the oviduct of another bird just when the latter is in the act of expelling an egg. This brings on a severe hæmorrhage, with the result that the other birds in the flock will pick at the bleeding part and often pull out the bowels and oviduct of the victim, causing it a cruel death. Where birds have acquired this vice the only safe course is to darken the nests, or arrange them in such a way that the oviduct of the bird cannot be seen or picked at when in the act of laying. When a bird is on the point of expelling an egg the oviduct protrudes more or less, and presents a highly flesh-coloured appearance. The latter condition no doubt induces the culprit, in its desire for animal food, to pick at and puncture this delicate organ. Careful observation will often locate the culprit, which will be frequently seen walking along the platform in front of the nest boxes waiting for an opportunity to resort to its cannibalistic inclination. It goes without saying that once such a bird is detected it should immediately be got rid of.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

EXTRACTING.

EXTRACTING should now be in full swing in all districts of the Dominion. Where operations for any reason have been delayed, care must be taken to see that the bees are not crowded out, or they will commence to loaf, and the ultimate crop will be small. It is a good policy to extract twice during the season; but where the beekeeper prefers to leave the work until the end of the flow a close watch should be kept so as to provide ample room. This, however, can only be done where large numbers of spare combs are kept on hand. It is during the season when honey is coming in freely that the beekeeper realizes that his most valuable asset, next to his bees, is a good stock of extracting-combs. Every effort should be made to get at least twenty spare combs for each hive in the apiary, and with this number always on hand the bees are not likely to be hampered for room.

In the absence of plenty of drawn-out combs the best plan is to keep the extractor going, and thus prevent the bees from blocking the brood-combs. This usually happens unless ample room is provided, and as a result the queens are prevented from laying to their utmost, and the colonies dwindle. At no time during the working season should the work of the queen be hindered. Care must always be taken to see to this important item during the flow. The honey is quite ready for extraction when the combs are three parts capped, but great care must be exercised not to extract unripe honey. Numerous instances have come under my notice where the practice of taking unripe honey has meant a total loss to the beekeeper.

STRAINERS.

It is not uncommon to find exposed for sale honey with which proper care and attention have not been paid to straining at the time of extracting. Nothing deters the sale of extracted honey so much as a layer of wax-particles, dead bees, &c., and it is surprising how few beekeepers take the necessary trouble to see that their product reaches the customer free from impurities. In no case should honey be run direct from the extractor into the containers; it should be properly strained. It is the attention paid to this necessary detail that aids in the sale of the crop, and when honey is properly treated it readily commands a higher price. Fine-gauge wire strainers are usually adopted, but even these are not sufficient to remove the smaller wax-particles. In order to ensure perfect condition the honey should be passed through good fine cheesecloth before being run into the tank. Cheesecloth strainers are excellent, cheap, and easily made, while at the same time they can be readily cleansed. They remove everything but the smallest particles of wax, which should be finally disposed of when the honey is skimmed. This latter process is an important one, and should always be carried out before the honey is put up in marketable form.

TESTING HONEY FOR RIPENESS.

Before tinning off the honey the apiarist should make sure that it is ripe. Fermentation is sometimes quite a serious problem, and yearly large quantities of honey which were thought to be well ripened at extracting-time ferment, more especially when left over till the weather

becomes warm. The bulk of our honey is exported, and a matter of first importance is its condition on arrival at the overseas market. Usually beekeepers experience little difficulty with low-specific-gravity honeys if care is exercised and only well-sealed combs are extracted from. However, to ensure that the honey is up to standard it should be tested with a hydrometer before being run into the tins.

When making the test the contents of the tank should be gently paddled in order that the honey may be of the same consistency throughout. This operation is of importance, as there is always a risk of variation of the specific gravity of the honey at the bottom and top of the tank. If on testing with a Twaddle's No. 4 hydrometer the instrument does not sink below 84 a well-ripened honey is indicated. This is equal to a specific gravity of 1.42, the test being made at a temperature of 60° F. As the temperature of honey in summer rarely sinks so low, the test may be taken at 70° or 80° by adding one point to the hydrometer-reading for each ten degrees of heat over 60°. Thus, if the hydrometer sinks to 82 at a temperature of 80°, it would register 83 if taken at 70°, and 84 if taken at 60°. To arrive at the specific gravity multiply the hydrometer-reading by 0.005. Thus $84 \times 0.005 = 0.420$; add 1 for the specific gravity of water and it will equal 1.420. This method is only reliable up to a temperature of 90°.

TESTING THICK HONEY.

Sometimes the honey is so dense that the hydrometer will not sink. When such is the case take equal parts by volume (not weight) of honey and water, mix thoroughly, test with a No. 2 Twaddle's hydrometer, and then multiply the result by 2. This will give the same result as if taken with a No. 4 instrument by the direct method. Thus, if the No. 2 instrument sinks into the honey and water to 42, this multiplied by 2 = 84. Perhaps the quickest and simplest method for testing thick honey is to have a deep glass or beaker on which is a mark to contain about 4 oz. of water. Fill up to the mark with water, then pour it into another vessel; now fill up to the mark with liquid honey, add the water previously measured, and mix thoroughly; then place in it the No. 2 hydrometer, note the number to which it sinks, and multiply by 10; place the decimal point before the result, and add 1. Thus, if it registers 43, $43 \times 10 = 430$; place the decimal point before the 430 = 0.430; to this add 1, which is the specific gravity of water, and the result will be 1.430. —*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

TOBACCO-GROWING.

IN the earlier-planted tobacco crops the lower leaves will now be changing colour; the green will be turning to a pale shade, and a slight yellow, mottled appearance is acquired. These are some of the indications of ripeness, and show the time has come for harvesting the crop. A careful judgment is required at this point, as immature leaf has poor colour and flavour when cured, while an overmatured leaf will come out of the cure in a mottled condition and without the necessary elasticity and texture. The aim must be for a cured leaf

of bright even colour, unbroken, with good body, and rather a tough elastic texture. This is usually obtained with the pipe tobaccos grown here by means of the air system of curing, with the help of occasional fires, in some instances, during a spell of humid weather. For the bright-yellow leaf a flue-heated kiln is required. Usually the leaf is cured on its stalk, the plant being cut off at the surface of the ground and the stalk split and threaded on the usual 4 ft. curing-stick. Lack of accommodation sometimes induces growers to crowd the plants on the sticks, which at first is rather an advantage, but later usually results disastrously in slow drying and the development of mildew. Green leaf requires to be handled with care when being taken to the drying-sheds, as it is when in that condition very easily broken or bruised, and in that way seriously damaged.

TOMATO HARVEST AND AFTER-MEASURES.

The harvesting of the glasshouse tomato crop usually closes at about this period. When that time arrives it is advisable to clean up the house promptly, as if this is omitted a heavy crop of fungi and insect pests is usually produced. Both economy and cleanliness demand this prompt attention. The plants are best dug up, freed from the supporting strings, and burnt, as, although vegetation makes an excellent manure, one would by turning it in undoubtedly infect the soil with the diseases present, and so increase the difficulties of another season when that crop is grown. Where white fly or other pests have been present it may even be necessary to fumigate the house with calcium cyanide, or, if fungus diseases have been troublesome, to spray the house and soil with formalin. 1 in 320. A crop of another kind is then sometimes planted, or the land is sown down in a green cover-crop for turning in.

The harvesting of the outside tomato crop will now be at its height. The progress in standard packing in the different districts last season was very commendable, and growers cannot fail to benefit from the adoption of whatever local standards that may be agreed upon. In some instances these took the form of uniform cases, labels, and marks. Such practice cannot fail to increase confidence among buyers and facilitate business. To do otherwise is to continue the confusion and disappointments that are making our markets expensive and ineffectual.

SMALL-FRUITS.

Where Cape gooseberries or passion-fruit are to be grown next season the seeds may be sown now to produce plants for setting out in the spring. Plantations of berry-fruited plants should be kept in condition by suitable spraying, and where growth is backward a dressing of sulphate of ammonia and sulphate of potash may be applied with advantage in most cases.

THE VEGETABLE GARDEN.

Crops of celery, cabbage, cauliflower, and leeks that are now established will be benefited by an application of fertilizers, also the beds of rhubarb and asparagus.

Seed-beds for the crop of spring cabbage and cauliflower should now be made and sown. A thin sowing will give hard, strong plants which will stand the winter.

HOME-MADE MANURES.

The large quantities and cost of manures required for the intensive culture of the present day make it desirable to exercise economy in using up all available supplies. Stable manure is now almost unprocureable, and one is inclined to depend entirely on "artificial" manures and green cover-crops; but many growers have other supplies available which it would be economical to make the most of.

Of these sundry supplies fowl-manure is one of the most popular. The present system of keeping poultry under cover makes the collection and storage convenient. The manure is usually kept in a dry state in benzine-tins and ground, or stacked with alternative layers of dry soil under cover. Its high nitrogen content, in addition to good percentages of phosphate and potash, makes it an excellent dressing for feeding growing crops. Some of these houses have a foot of dry soil on the floor, besides straw, for the fowls to dust and scratch in. If this is removed annually during winter, spread on the land and turned in, it makes an effective dressing. In the poultry-house it is replaced with fresh soil, with, no doubt, mutual satisfaction.

Wood-ashes, charcoal, and soot, when obtainable in any quantity, are too valuable to throw away. The wood-ash is rich in lime, soda, and potash, and the soot in sulphate of ammonia; but chemical analysis does not by any means exhaust the list of beneficial qualities of the materials referred to, such as mechanical improvement of the soil and as insecticides. As the qualities of value in these substances are water-soluble they have to be kept in a dry place. Wood-ashes and soot are in high favour as a dressing for land just before sowing it down in onions. Soot is also used for dusting young plants, which it protects from insects while the plants are fed with nitrates.

The high chemical value of sheep-manure makes it an article of commerce in some countries. There it is dried and ground and sold in sacks. It is highly concentrated, although not equal to fowl-manure, than which it is less caustic. In it the three main plant-foods are well proportioned, and it may generally be used freely without doing harm. Where it is readily obtained in quantities, as under the gratings of the wool-shed, it has many advantages over "artificial" that cost more.

Cow-manure has a very low chemical analysis, but organic manures cannot be correctly valued on that basis alone. The grower of cucumbers under glass would probably prefer it to any other, even including those with a higher analysis. Its mild action enables it to be used beneficially on crops which fail to respond to strong manures.

Another resource that is available to many in this country with its long coast-line is seaweed. Its analysis is equal to that of farm-yard manure—in fact, it excels the latter in potash, and is held in high esteem especially for root crops. Where carting can be arranged, this material is well worth consideration.

Such supplies of this kind as may be required should now be accumulated, so that they may be ready for ploughing in during the autumn on such areas as require heavy manuring; also for application to breaks of berry fruits during the winter.

—W. C. Hyde, *Horticulturist*.

THE NEW DAIRY-PRODUCE REGULATIONS.

MANUFACTURE AND EXPORT.

W. M. SINGLETON, Director of the Dairy Division.

THE old regulations under which the dairy industry has hitherto been guided, so far as export is concerned, were gazetted in 1899. Dr. J. A. Ruddick was then Dairy Commissioner for New Zealand, and was ably assisted in the drafting of the regulations by Mr. R. Evatt, then Chief Clerk of the Agriculture Department; Mr. J. D. Ritchie, then Secretary for Agriculture, also took a close part in the matter generally. Those regulations referred almost entirely to the registration of dairy factories, and to the branding and storing of dairy-produce. The drafting was well done, and the regulations, so far as they went, have, in effect, been carried forward to a considerable extent into the new Dairy-produce General Regulations gazetted on 25th November last.

During the twenty-seven years which have elapsed since the issue of the regulations of 1899 the dairy industry has expanded enormously in New Zealand. The tonnage of butter and cheese exported has increased from 7,608 tons in 1899 to 131,237 tons in 1925. The advent of the farm separator and the milking-machine; the manufacture of milk-powder, casein, milk-sugar, and whey butter; the pasteurization of cream and milk for butter and cheese making; the extension of the grading of cream, and the necessity for ensuring more exact methods of testing for butterfat at some dairy factories; the extension of cold storage for butter, and of cool storage for cheese—these, and other developments, together with the recognized need for more improved methods respecting cleanliness and sanitation at a number of milking-sheds, made it essential that a more specific guide should be issued to assist those connected with the industry.

There is really little embodied in the new regulations immediately affecting dairy companies and suppliers which is not in practice at many of our well equipped and managed dairy factories and dairy farms. From this viewpoint the issue of the regulations is mainly an official endorsement of present good practice. The principal factor which made it wise to issue these regulations at the present juncture was the necessity for some additional definitions and authorities in connection with cream-grading and the testing of milk and cream at dairy factories. The dairying community pressed the Government for legislation respecting these matters, and, having obtained that legislation, regulations were required accordingly. This being the case, together with the fact that the then existing regulations were so old and circumscribed, it was deemed advisable to review the whole position, and include the cream grading and testing for butterfat regulations with such others as would bring the general position up to the present requirements.

Hitherto the Dairy Division has relied very largely on certain provisions of the Dairy Industry Act rather than on regulations under that Act. From that point of view the regulations cannot be stronger

than the Act which they are under, and instead of being accepted as conferring further powers they should be accepted as an interpretation of certain sections of the Act.

It will be generally conceded that in its administration of the Act the Dairy Division has hitherto been moderate. Prosecutions or other arbitrary action on the part of the Division have been conspicuous by their absence. This has been due to the co-operation and good will which the Division has been accorded by those in the dairy industry. It is hoped and expected that the same spirit of co-operation, in conjunction with continued moderation on the part of the Division in administration of the new regulations, will perpetuate the good feeling which has obtained hitherto.

For further publicity and convenient record purposes it has been deemed advisable to publish in the *Journal* the full text of the new regulations (only omitting most of the various appended "forms" referred to therein) as follows :-

REGULATIONS.

Interpretation.

1. (1.) THESE regulations may be cited as "The Dairy-produce General Regulations."

(2.) For the purposes of these regulations, unless the context otherwise requires,—

"Approved" means approved by the Director in writing :

"Cream-grader" means any Cream-grader certificated in accordance with these regulations :

"Director" means the Director of the Dairy Division of the Department of Agriculture.

"Dried milk" means the substance produced when whole milk, skim-milk, butter-milk, or a mixture of cream, whole milk, skim-milk, butter-milk, sugar of milk, or any two or more of these substances, is evaporated or dried :

"Factory" used without the word "dairy" prefixed means a manufacturing dairy used or intended for the manufacturing of cheese, other than a manufacturing dairy registered as a private dairy :

"Grader" used without the word "cream" prefixed means any Dairy-produce Grader appointed under the said Act :

"Inspector" means any Inspector appointed under the said Act :

"Manufacturing dairy" includes any premises of the descriptions enumerated in subclause (1) of clause 7 of these regulations :

"Occupier" of a supplying dairy includes every person having for the time being the management or control thereof :

"Supplying dairy" means any dairy within the meaning of the said Act used in connection with the supply of milk or cream to a manufacturing dairy :

"Whey butter" means butter manufactured from whey cream :

"Whey cream" means cream extracted from whey, and includes any mixture of milk, or cream extracted from milk, with cream extracted from whey :

(3.) These regulations, with the exception of clause 31 hereof, shall not apply to a dairy, or to the butter or cheese manufactured at a dairy, of which the supply of milk and cream is derived from an average number in any month of not more than fifty cows and which is not registered under these regulations : Provided that no butter or cheese is manufactured at such dairy except butter and cheese which is produced entirely from milk or cream derived from cows on that dairy and which is not manufactured for export and is not exported : save that every such dairy in which any dairy-produce is manufactured for sale shall be deemed to be a supplying dairy for the purposes of clauses 14, 15, 16, and 17 of these regulations.

Requirements as to Use of Manufacturing Dairies.

2. Subject to the provisions of subclause (3) of clause 1 hereof, it shall not be lawful for any person to manufacture, receive or deposit for subsequent manufacture, or pack or seal into airtight packages, any dairy-produce, or to mix or blend any butter, except in accordance with these regulations and in a manufacturing dairy duly registered.

3. In particular it shall not be lawful for any person—(a) To manufacture butter other than whey butter except in a manufacturing dairy registered as a creamery or private dairy; (b) to manufacture cheese except in a manufacturing dairy registered as a factory or private dairy; (c) to manufacture whey butter, condensed or preserved milk, casein, dried milk, or sugar of milk except in a manufacturing dairy registered as a whey-butter factory, condensed- or preserved-milk factory, casein-factory, dried-milk factory, or sugar-of-milk factory respectively; (d) to pack or seal butter into airtight tins or other airtight packages except in a manufacturing dairy registered as a tinning-house; (e) to mix or blend butter into milled butter except in a manufacturing dairy registered as a packing-house: Except that—(i) The separation of butterfat from milk may be carried on (a) at any supplying dairy in respect only of the milk produced on that dairy, or (b) at any manufacturing dairy registered as a skimming-station; (ii) the preparation for transport to a casein-factory of the curd from milk of any kind may be carried on at a manufacturing dairy registered as a precipitating-station; (iii) milk or cream produced on any supplying dairy may be deposited on such dairy

4. It shall not be lawful for any person—(a) To use a manufacturing dairy registered only as a skimming-station for subjecting dairy-produce to any other process of manufacture than the separation of butterfat from milk; (b) to use a manufacturing dairy registered only as a cream-receiving depot for any purpose for which a manufacturing dairy may be used other than for the receipt or deposit of cream for subsequent removal without being subjected to any process of manufacture while at such cream-receiving depot; (c) to use a manufacturing dairy registered only as a precipitating-station for subjecting dairy-produce to any other process of manufacture than the preparation for transport to a casein-factory of the curd from milk of any kind.

5. It shall not be lawful for the owner of any manufacturing dairy to receive cream for subsequent removal (without being subjected to any process of manufacture prior to such removal) except in a manufacturing dairy registered as a cream-receiving depot, creamery, factory, or private dairy.

6. Any person intending to build, or to make substantial structural alterations to, a dairy of any of the classes enumerated in paragraph (a), (b), (d), (e), (f), (g), (h), (k), or (m) of subclause (1) of clause 7 hereof shall submit a description and plan of the proposed building or alterations to the Director, and shall not commence the erection of the building or the making of the alterations until the Director has notified him in writing that the Minister has approved of the description and plan. No person erecting any such building or making any such alterations shall make any material departure from the description and plan as approved by the Minister, either before or during the erection or alteration of the building or at any later time, without previous written notice from the Director that the Minister has consented thereto.

Registration of Manufacturing Dairies.

7. (1.) Manufacturing dairies shall be registered as belonging to one or more of the following classes: (a) creamery; (b) factory; (c) private dairy; (d) whey-butter factory; (e) condensed- or preserved-milk factory; (f) casein-factory; (g) dried-milk factory; (h) sugar-of-milk factory; (i) tinning-house; (j) packing-house; (k) skimming-station; (l) cream-receiving depot; (m) precipitating-station.

(2.) The same premises may be registered as belonging to more than one of the foregoing classes. Where premises are registered as belonging to more than one class a separate certificate shall be issued in respect of each registration.

8. (1.) No premises shall be registered as a creamery unless, in the opinion and to the satisfaction of the Director, they—(a) Are equipped with all the necessary appliances for the manufacturing of butter and for completely controlling the temperature of the produce at each stage of the process; and (b) are provided with good drainage and an efficient water-supply.

(2.) No premises shall be registered as a factory unless, in the opinion and to the satisfaction of the Director, they—(a) Are equipped with all the necessary appliances for the manufacturing of cheese on the factory system; (b) include curing-room accommodation and suitable shelving for at least fourteen days' make of cheese; and (c) are provided with good drainage and an efficient water-supply.

(3.) No premises shall be registered as a whey-butter factory unless they are, in the opinion and to the satisfaction of the Director, equipped with machinery for completely controlling temperatures.

(4.) No premises shall be registered as a manufacturing dairy of any class unless, in the opinion and to the satisfaction of the Director, they are sanitary, and in all other respects reasonably suitable for use as a manufacturing dairy of the class in which registration is desired.

(5.) Premises for the manufacture of butter or cheese which are not sufficiently equipped with appliances, drainage, and water-supply to warrant their registration as a creamery or factory may be registered as a private dairy.

9. (1.) The owner of any premises who desires to have them registered as a manufacturing dairy under these regulations shall make application in writing to the Director, in or to the effect of form No. 1 in the Schedule hereto, and shall in such application specify the class or classes of manufacturing dairy to which it is desired that the premises shall be registered as belonging, and shall give particulars of the proposed brand which he wishes to be registered for use on dairy-produce manufactured in the said premises.

(2.) Upon being satisfied that the statements in the application are true and that all the requirements of these regulations are complied with in respect of such premises and brand, the Director shall register the premises as a manufacturing dairy of the class or classes specified in the application, and with a distinctive number, and shall register the brand, and shall issue to the owner a certificate or certificates of registration in the form No. 2 in the Schedule hereto.

(3.) In every case registration of premises shall be deemed to be registration thereof as a manufacturing dairy only of the class or classes specified in the application for registration.

10. (1.) The Director may decline any application for registration on the ground that the proposed brand is identical with any existing brand, or resembles any existing brand so nearly as to cause risk of confusion, or is for any other reason undesirable for use as a brand for dairy-produce.

(2.) On the application in writing of the owner and with the approval of the Director the registration of any brand may be revoked and another brand registered in lieu thereof, and the Director shall thereupon make the necessary alterations in the certificate of registration and in the register.

(3.) On the registration of any premises where the manufacture of butter or cheese is not carried on the Director may, in his discretion, dispense with the registration of a brand.

11. (1.) The Director shall cause a register to be kept of every certificate of registration of any premises and brand from time to time in force, and every cancellation of a certificate shall at once be recorded in the register.

(2.) A copy certified by the Director of any entry in the register shall be *prima facie* evidence of such entry and of the facts appearing therein, and a certificate under the hand of the Director of the absence of an entry in the register shall be *prima facie* evidence of the facts stated in such certificate.

(3.) Every certificate of registration shall continue in force until cancelled under the provisions in that behalf hereinafter contained.

(4.) A certificate of registration issued under any regulations heretofore in force shall enure as if it were a certificate issued hereunder of registration as a manufacturing dairy of such class or classes as, having regard to the purport of such certificate, the Director may decide.

12. (1.) So long as the certificate continues in force, but no longer, the dairy named therein shall be deemed to be a registered manufacturing dairy of the class specified in the certificate, and the owner named therein shall be deemed to be the registered owner of the dairy.

(2.) In the event of the registered owner ceasing to be the owner of the dairy the Director, upon being satisfied as to the facts, may write on the certificate the words "Transferred to [Full name and address of the new owner], and transfer recorded, this day of , 19 , " and sign such writing, and shall thereupon record the transfer in his register accordingly, whereupon the new owner shall be deemed to be the registered owner.

18. The certificate may be cancelled by the Director in any of the following events: (a) If the registered owner so requests; or (b) if the Director is satisfied that the owner has not used his registered premises and brand for a period of not less than six months immediately preceding, or (c) if during any period of twelve months the owner has been at least thrice convicted of any offence or offences under the said Act or any regulations made thereunder; or (d) if the owner fails or neglects to remedy within the time specified in the notice any defect in the sanitary condition in or about the dairy or its appliances when required by an Inspector so to do by notice in the form No. 3 in the Schedule hereto.

Milking-machines.

14. The owner and occupier of every supplying dairy shall, with respect to every milking-machine used in such supplying dairy, comply with the following provisions; provided that nothing in this clause shall be held to make compulsory the installation of a vacuum-tank or releaser: (a.) The releaser and vacuum-tank shall be either in the open air or in an apartment (hereinafter called the releaser-room) other than that used for milking (hereinafter called the milking-shed), and if the releaser-room is under the same roof as the milking-shed there shall be between the releaser-room and the milking-shed a complete and draught-proof partition, or, in the alternative, a passage walled on both sides throughout the width and height of the releaser-room, open to the outer air at both ends, and not less than two feet wide throughout (b.) No internal-combustion or steam engine shall be in the same room as the releaser or cream-separator (c.) An adequate water-supply, and a suitable plant for the boiling of sufficient water for thoroughly cleaning the milking-machine and its appurtenances, shall be installed and maintained near the machine. (d.) The body of the vacuum-tank shall be in two parts, or, in the alternative, the diameter of the cover shall be as nearly as possible equal to that of the tank. (e.) The releaser and vacuum-tank shall be coupled together by short removable connections (f.) The connections to the vacuum-tank, from the vacuum-pump, releaser, and milking-shed vacuum-pipe respectively, shall be as straight as possible, and, if it is reasonably practicable, shall be independent of each other (g.) The milk-pipe shall be of brass, tinned on the inside, and no iron piping, whether galvanized or not, shall be used in the vacuum or releaser system. (h.) The vacuum-pump, vacuum-tank, and releaser shall be so installed and maintained that all lines of pipes shall be as straight as possible. (i.) The milk-pipe and vacuum-pipes shall have a sufficient fall, which shall be provided and maintained so as to be as regular as possible, for the purpose of proper drainage

Care of Milk and Cream.

15. (1.) All separation of cream from milk at any manufacturing dairy or at any supplying dairy shall be done in a room that is well lighted and ventilated, and provided with a substantial floor and drain, both made of concrete or other material impervious to moisture and having a smooth surface capable of being readily cleansed

(2.) In every supplying dairy in which the separator-room or milk-collecting room is under the same roof with an engine-room there shall be a passage, walled on both sides throughout the width and height of the separator-room or milk-collecting room, open to the outer air at both ends, and not less than two feet wide throughout, between the engine-room and the separator-room or milk-collecting room.

(3.) The owner of every manufacturing dairy shall comply with the requirements of this clause so far as they relate to manufacturing dairies, and the owner and occupier of every supplying dairy shall comply with the requirements of this clause so far as they relate to supplying dairies

16. (1.) Milk intended for delivery to a manufacturing dairy shall, immediately after milking, be removed from the milking-shed or stockyard, and once at least carefully strained through some apparatus sufficient for the purpose, and then cooled to a temperature of not more than 65 degrees Fahrenheit by being run over a water cooler or by setting the containers in cold water.

(2.) Cream intended for delivery to a manufacturing dairy shall, immediately after having been separated, be cooled to a temperature of not more than 65 degrees Fahrenheit by being run over a water cooler or by setting the containers in cold water.

(3.) The occupier of every supplying dairy shall comply with the requirements of the preceding subclauses of this clause in respect of all such milk and cream produced on the supplying dairy of which he is the occupier.

(4.) (a.) All cream intended for delivery to a manufacturing dairy shall from the time when it is separated to the time when it is deposited in such manufacturing dairy be at all times adequately protected from the sun. (b.) The occupier of every supplying dairy shall comply with the requirements of this subclause until the delivery of such cream to the owner of the manufacturing dairy or to some person on his behalf. (c.) The owner of every manufacturing dairy shall comply with the requirements of this subclause from the time of receipt of such cream by such owner or by any person on his behalf. (d.) Every person for the time being having the actual possession or custody of any such cream shall comply with the requirements of this subclause during the period of such possession or custody: Provided always that the liability imposed by this paragraph is without prejudice to the liability of any other person under paragraph (b) or paragraph (c) of this subclause.

Disinfectants on Teats and Utensils.

17. No occupier of any supplying dairy shall use or allow to be used on the teats of cows in milk or on dairy utensils any poisonous or markedly odorous disinfectants such as coal-tar derivatives.

(To be continued.)

FORTHCOMING AGRICULTURAL SHOWS.

Horowhenua A. and P. Association: Levin, 25th and 26th January, 1927.

Rangitikei A. and P. Association: Taihape, 26th and 27th January.

Helensville A. and P. Association: Helensville, 29th January.

Golden Bay A. and P. Association: Motupipi, 1st February.

Feilding A. and P. Association: Feilding, 1st and 2nd February.

Woodville A. and P. Association: Woodville, 4th and 5th February.

Omaha and Pakiri A. and H. Association: Leigh, 5th February.

Kawakawa A. and P. Association: Kawakawa, 5th February.

Clevedon A. and P. Association: Clevedon, 5th February.

Te Puke A. and P. Association: Te Puke, 9th February.

Dannevirke A. and P. Association: Dannevirke, 9th, 10th, and 11th February.

Pahiatua A. and P. Association: Pahiatua, 12th February.

Rodney Agricultural Society: Warkworth, 12th February.

Masterton A. and P. Association: Solway, 15th and 16th February.

Whakatane A. and P. Association: Whakatane, 16th February.

Te Awamutu A., P., and H. Association: Te Awamutu, 16th February.

Buller A. and P. Association: Westport, 18th and 19th February.

Marton A. and P. Association: Marton, 23rd February.

North Kaipara Agricultural Association: Paparoa, 25th February.

Franklin A. and P. Association: Pukekohe, 25th and 26th February.

Waikato Central Agricultural Association: Cambridge, 2nd and 3rd March

Mongonui County A. and P. Association: Kaitaia, 5th March.

Opotiki A. and P. Association: Opotiki, 8th March.

Morrinsville A., P., and H. Society: Morrinsville, 9th March.

Amuri A. and P. Association: Waiau, 9th March.

Taranaki Metropolitan Agricultural Society: New Plymouth, 9th March.

King country Central A. and P. Association: Te Kuiti, 10th March.

Mayfield A. and P. Association: Mayfield, 19th March.

Rotorua A. and P. Association: Rotorua, 23rd March.

Methven A. and P. Association: Methven, 25th March.

Temuka A. and P. Association: Geraldine, 7th April.

Mackenzie County A. and P. Society: Fairlie, 18th April.

Association secretaries are invited to supply dates and location of their shows for publication in this list.

EXPORT OF APPLES AND PEARS, 1927 SEASON.

I. CONDITIONS OF GOVERNMENT GUARANTEE.

CONDITIONS for the Government guarantee on shipments of apples and pears made from New Zealand during the 1927 export season are as follows.—

1. The guarantee shall be limited to approved varieties and classes of apples and pears packed in compliance with the requirements of "Extra Fancy" and "Fancy" grades.

2. The Government guarantees to the grower a gross market price of 11s 6d. per case on all cases of such apples and pears exported by him in accordance with the conditions set out herein. (With respect to South American markets the gross price shall be considered to be the c.i.f. price, plus 1s 6d per case selling-charges.)

3. The guarantee shall be limited to apples and pears grown and shipped (otherwise than under an f.o.b. contract) by *bona fide* fruitgrowers or fruitgrowers' co-operative societies, through the New Zealand Fruit-export Control Board or other channels approved by the Minister of Agriculture.

4. Any grower who exports any portion of his fruit crop outside the guarantee shall be deemed to have forfeited his right to participate in the guarantee with respect to all fruit exported during the season by him or on his behalf, save that any grower, if he so desires, may ship the whole of his pears outside the guarantee without prejudice to his apple shipments under the guarantee, and *vice versa*.

5. All apples and pears to qualify for the guarantee must be passed by an Inspector of the Department, and must be packed in accordance with the Export Regulations, subject to the modifications and directions set out in the appended statement entitled "Export Regulations."

6. Payment of claims under the guarantee shall be calculated on the basis of the average gross price per case received by the claimant for the whole of the apples and pears approved under the guarantee and exported on his account during the season to all markets, and only the deficiency between the average gross price realized for such fruit and 11s 6d shall be payable under the guarantee.

7. Where, however, apples or pears of more than one variety and supplied by more than one grower are exported by a joint packing company or group in its own name, the guarantee shall be calculated separately in respect of the whole of the fruit supplied for export by each grower, on the basis of the pool price received for each variety supplied by him; provided that the joint packing company or group shall have, not later than seven days after the fruit has been shipped from New Zealand, notified to the Director of the Horticulture Division full particulars of each grower's fruit included in each shipment.

8. The Government reserves to itself the right (a) to withhold the guarantee from any grower who, in the opinion of the Director of the Horticulture Division, is not satisfactorily grading out, and exporting separately, his "Extra Fancy" and "Fancy" grade fruits; (b) to withhold from any grower the guarantee with respect to any variety of "Fancy" grade fruit in the event of the Director of the Horticulture Division being satisfied that such grower is not shipping a reasonable proportion of his "Extra Fancy" grade fruit of that variety; (c) to withhold the guarantee from any grower who sells, except for consumption within New Zealand, any portion of his fruit crop without the approval of the Director of the Horticulture Division; (d) to limit the quantity of fruit shipped to any particular port should freight rates or market conditions, &c., be deemed unsatisfactory; (e) to insist on fruit being precooled prior to shipment if deemed necessary; (f) to withhold the privileges of the guarantee from all fruit shipped in vessels the storage facilities of which are held by the Department to be unsatisfactory; (g) to withhold the privileges of the guarantee with respect to any market in connection with which the New Zealand Fruit-export Control Board is of the opinion that satisfactory f.o.b. or c.i.f. trade is or can be established; (h) to withhold the guarantee with respect to any fruit packed contrary to such instructions as may be issued by the Department of Agriculture, after discussion with the accredited representative

of the Fruit Control Board and the shipping agents of the fruitgrowers concerned, calling for a cessation of packing during any specified period, owing to the lack of shipping facilities or other causes.

9. The Government reserves the right to re-examine and to withdraw any fruit from export in the event of such re-examination indicating that by reason of over-maturity or other cause inimical to the keeping-qualities of the fruit it would be inadvisable to allow such fruit to be exported. All fruit so withdrawn may be disposed of in New Zealand by the owner without reference to the guarantee, or by the Government on behalf of the owner. In the latter event the proceeds will be credited to the owner, and the transaction dealt with generally as though the fruit had been actually exported under the guarantee. But should such re-examination reveal the fact that any line of fruit, through careless or faulty packing, is decidedly below the standard required, it will be deemed not to be covered by the guarantee, and the owner of such fruit may, at the option of the Minister, be held to have forfeited all right to participate in the guarantee for the remainder of the season.

(N.B.—No apples or pears carrying more than one hundredth part of a grain of arsenic per pound shall be approved for export under the guarantee or otherwise.)

2. EXPORT REGULATIONS.

The following regulations shall apply to all fruit—apples and/or pears, as the case may be—intended for export under the Government guarantee, 1927. —

APPLE GRADES AND VARIETIES.

The standard grades shall be as follows :—

"Extra Fancy" Grade—Apples of this grade shall be mature, sound, smooth, clean, well formed, hand-picked, true to name, and free from disease, visible bitter-pit, skin-puncture, or skin broken at stem, and other defects. Slightly blemished apples may be included in this grade provided that no individual apple shall have more than 5 per cent. of its surface affected thereby. Apples affected by unnatural russet may also be included in this grade provided that no individual apple shall have more than 5 per cent. of its surface affected thereby. The individual apples of solid red, partial red, and striped varieties shall carry not less than 65 per cent., 40 per cent., and 25 per cent. respectively of good typical colour. The individual apples of yellow or green varieties shall be of good characteristic colour.

"Fancy" Grade.—Apples of this grade shall be mature, sound, smooth, clean, well formed, hand-picked, true to name, and free from disease, visible bitter-pit, skin-puncture, or skin broken at stem, and other defects. Slightly blemished apples may be included in this grade provided that no individual apple shall have more than 5 per cent. of its surface affected thereby. Apples affected by unnatural russet may also be included in this grade provided that no individual apple shall have more than 10 per cent. of its surface affected thereby. The individual apples of solid red, partial red, and striped varieties shall carry not less than 30 per cent., 15 per cent., and 10 per cent. respectively of good typical colour. The individual apples of yellow or green varieties shall be of good characteristic colour.

The principal requirements of the above grades are as set out below :—

Grade.	Colour				Maximum Defects.
	Solid Red.	Partial Red.	Striped.	Yellow or Green.	
	Per Cent.	Per Cent.	Per Cent.		
Extra Fancy	65	40	25	Good characteristic colour	5 per cent. blemish ; 5 per cent. unnatural russet.
Fancy ..	30	15	10	Good characteristic colour	5 per cent. blemish ; 10 per cent. unnatural russet.

The standing of the New Zealand apple trade in England has been detrimentally affected by the large number of varieties shipped each season, many of which represent a few cases only, whilst others are not at all suitable for the market. All those that have been shipped in small quantities, unless specially favoured, will not be again accepted, and therefore do not appear on this season's export list. These include Allington Pippin, Baldwin, Blenheim Orange, Cambridge Pippin, Commerce, Crofton, Duke of Clarence, Golden Russet, Horn, John Sharp, Sharp's Late Red, and Wagner.

Apart from these the list still includes a number of more or less unsuitable varieties, such as Alfriston, Boston Russet, Brownlee's Russet, Golden Pippin, Hoover, London Pippin, Parlin's Beauty, Salome, Shepherd's Perfection, Edward Lippiatt, Pioneer, Premier, Ribston Pippin, Scarlet Pearmain, Stark.

Orchardists who are growing these varieties are strongly advised to work them over with more suitable kinds as early as possible, and in this connection are requested to note that year by year this list will be referred to and notice given that a certain number of the varieties named will not be approved for export after a stated period. In pursuance of this intention notice is now given that those varieties marked * will not be accepted for export after the season of 1929

APPROVED FOR EXPORT TO EUROPE.

Max. Size.	Variety.	Min. Size.	Max. Size.	Variety	Min. Size.
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Solid Red Varieties.

100	Hoover ..	216	113	Rokewood ..	216
113	McIntosh Red ..	216	100	Tasma ..	216

Partial Red Varieties.

113	Brighton ..	216	113	Scarlet Nonpareil ..	234
113	Delicious ..	216	113	Scarlet Pearmain*	216
113	Dougherty ..	216	113	Shepherd's Perfection..	216
113	Edward Lippiatt*	216	113	Shorland Queen ..	216
113	Frimley Beauty ..	216	100	Spitzenberg ..	216
113	Jonathan ..	234	113	Stark*	216
113	King David ..	234	113	Worcester Pearmain ..	216
100	Rome Beauty ..	216	113	Yates ..	234
113	Salome ..	216			

Striped Varieties.

113	Adams Pearmain ..	216	113	Senator ..	216
125	Cox's Orange ..	234	113	Simmonds Winter ..	216
100	Premier* ..	216	113	Statesman ..	216
125	Ribston Pippin*	216	113	Stayman Winesap ..	216

Yellow or Green Varieties.

100	Alfriston ..	198	113	Gravenstein ..	216
100	Ballarat ..	180	100	London Pippin ..	198
100	Boston Russet ..	216	100	Lord Wolseley ..	198
113	Brownlee's Russet ..	216	113	McMahon's White ..	216
113	Celo ..	216	113	Newtown Pippin ..	216
113	Cleopatra ..	234	100	Parlin's Beauty ..	198
100	Dunn's ..	198	113	Pioneer* ..	216
113	Golden Pippin ..	216	113	Sturmer ..	234
113	Grannie Smith ..	234	113	Willie Sharp ..	198

APPROVED FOR EXPORT TO SOUTH AMERICA.

"Extra Fancy" grade apples only shall be approved for these markets.

Max. Size.	Variety.	Min. Size.	Max. Size.	Variety.	Min. Size.
<i>Solid Red Varieties.</i>					
96	Rokewood ..	125	72	Tasma ..	125
<i>Partial Red Varieties.</i>					
72	Delicious ..	125	88	Salome ..	125
80	Dougherty ..	125	88	Scarlet Nonpareil ..	125
96	Jonathan ..	125	96	Shorland Queen ..	125
96	King David ..	125	90	Spitzenberg ..	125
72	Rome Beauty ..	125	96	Stark* ..	125
<i>Striped Varieties.</i>					
80	Premier* ..	125	80	Stayman Winesap ..	125
96	Statesman ..	125			
<i>Yellow or Green Varieties.</i>					
96	Cleopatra ..	125	72	Dunn's ..	125

(N.B.—The aforementioned maximum and minimum sizes refer to Canadian case packs; but, as this case when packed with the necessary bulge ($\frac{1}{2}$ in. top and bottom) holds more apples of any given size than the normally packed New Zealand standard case, the maximum and minimum number of apples in reference to the latter case shall be the next lower packing count, as shown on the New Zealand standard-case packing-chart, to those set out above as the maximum and minimum sizes of each variety.)

REGISTERED EXPORT NUMBER.

The registered number issued to all growers under the Local-market Regulations will be declared to be the grower's registered export number also. The registered number of each grower must be branded on each case of fruit exported by him, provided that in the event of any group of growers pooling their fruit for export such group may designate its fruit by using any pool number allotted by the New Zealand Fruit-export Control Board. Likewise any packing organization to which a registered number has been allotted may use such registered number only, provided that in either instance each individual grower's fruit is shown separately on the advice-note for examination, and stacked in separate lots, so that the Inspector may have no difficulty in identifying the particular lot under examination.

Should unavoidable circumstances prevent the adoption of this procedure, resulting in a line comprising a large number of cases being submitted as one line, it must be definitely understood that the examination of same will be solely at the grower's risk, and in the event of any fruit forming a portion of the line being found to be unsatisfactory the whole line will be liable to rejection.

PACKING.

Plain or corrugated strawboard or wood-wool shall be used on top and bottom of cases.

WRAPPING-PAPER.

Apples of the various sizes as set out below shall be wrapped in paper of the size indicated opposite each respectively:—

Sizes 64's to 80's (both inclusive), paper 11 in. by 11 in.

Sizes 88's to 113's (both inclusive), paper 10 in. by 10 in.

Sizes 125's to 198's (both inclusive), paper 9 in. by 9 in.

Sizes 216's to 234's (both inclusive), paper 8 in. by 8 in.

In the event of the size of the paper used being smaller than that specified above for any respective size of apples, such apples shall be double-wrapped by overlapping two papers.

SPECIFICATION OF EXPORT CASE.

CANADIAN STANDARD.

Inside measurements: $10\frac{1}{2}$ in. by $11\frac{1}{2}$ in. by 18 in.

Ends: $10\frac{1}{2}$ in. by $11\frac{1}{2}$ in. by $\frac{3}{4}$ in., two pieces (each planed on the outer side).

Sides: 10 in. by $19\frac{1}{2}$ in. by $\frac{5}{16}$ in., two pieces (one board for each side).

Tops and bottoms: $5\frac{1}{2}$ in. by $19\frac{1}{2}$ in. by $\frac{3}{16}$ in., four pieces (two each for top and bottom).

Cleats: $11\frac{1}{2}$ in. by $\frac{3}{4}$ in. by $\frac{5}{16}$ in., four pieces (one across each end both top and bottom).

The Canadian standard case has been substituted for the New Zealand standard case for export purposes, but any grower having timber on hand of the New Zealand standard measurements may use cases constructed of such timber for the 1927 season only. Apart from this provision the specifications of the Canadian export case shall be strictly adhered to.

Local timber recommended for the construction of export cases is white-pine of good quality; but *Pinus insignis*, rimu, and beech timber, if well and evenly cut and used, with flexible white-pine tops and bottoms, will be accepted.

Nailing: Nails used to be not less than $1\frac{1}{2}$ in long, 14 gauge. Nails to be spaced not more than 3 in. apart, and the outer nails of each board to be not more than 1 in. from the edge of board.

Strapping: All cases to be strapped with a wire or steel band; such strapping to be tightly applied, and to be not more than 1 in. from end of case.

LABELLING AND MARKING

Each end of each case of fruit intended for export must bear a coloured label of one or other of the designs adopted by the New Zealand Fruit-export Control Board for the purpose of designating "Extra Fancy" and "Fancy" grades.

The marking of cases shall be in accordance with the previous season's requirements.

PEARS.

Varieties approved for export to Europe:—

Max. Size.	Variety.	Min. Size.	Max. Size.	Variety.	Min. Size.
In.		In	In		In.
$2\frac{3}{4}$	Josephine de Malines ..	$2\frac{1}{4}$	$2\frac{3}{4}$	Winter Cole ..	$2\frac{1}{4}$
$2\frac{3}{4}$	P. Barry ..	$2\frac{1}{4}$	$2\frac{3}{4}$	Winter Nelis ..	$2\frac{1}{4}$
$2\frac{3}{4}$	Packham's Triumph ..	$2\frac{1}{4}$			

PEAR PACKAGES

Pears for export shall be packed in wooden trays having an inside measurement of $11\frac{1}{2}$ in. by 18 in., with depth from $2\frac{1}{2}$ in. to 3 in. Each tray to be complete with lid and label. Three trays to be securely wired together, forming one package. Binding-wires to be placed within 1 in. of each end of the package.

In the construction of trays on the basis of sets of three to the package the following is recommended: Bottom of bottom tray and top of top tray to be of two pieces, each $5\frac{1}{2}$ in. by $\frac{5}{16}$ in. Tops and bottoms in all other instances to be of two pieces, each $5\frac{1}{2}$ in. by $\frac{3}{16}$ in. Middle tray to have cleats across each end both top and bottom, thus requiring four cleats, $\frac{3}{4}$ in. by $\frac{5}{16}$ in. by $11\frac{1}{2}$ in. Constructed in this way any bulge that takes place is inward, owing to the timber being lighter than the outer tops and bottoms. At the same time any such bulge is protected by the cleats, which also keep the trays apart, thus allowing for free ventilation.

Specification of Trays in Sets of Three.

Ends: $11\frac{1}{2}$ in. by 3 in. (or $2\frac{1}{2}$ in.) by $\frac{3}{4}$ in., six pieces.
 Sides: $19\frac{1}{2}$ in. by $2\frac{1}{2}$ in. by $\frac{3}{4}$ in., six pieces.
 Tops and bottoms: $19\frac{1}{2}$ in. by $5\frac{1}{2}$ in. by $\frac{3}{4}$ in., four pieces.
 Tops and bottoms: $19\frac{1}{2}$ in. by $5\frac{1}{2}$ in. by $\frac{3}{4}$ in., eight pieces.
 Cleats: $11\frac{1}{2}$ in. by $\frac{3}{4}$ in. by $\frac{3}{4}$ in., four pieces.

Labels for Trays.

Special labels for use on pear-trays have been prepared, and will be procurable from the New Zealand Fruitgrowers' Federation.

MINIMUM CONSIGNMENT.

Twenty cases of any one variety of either apples or pears shall be the minimum consignment accepted for export.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 18th November to 16th December, include the following of agricultural interest.—

No. 57366: Cream-cooler; E. D. Berry, Palmerston North. No. 57337: Cattle-food-mixing machine; A. J. Palmer, Palmerston North. No. 54627: Cultivator; G. P. Potter, Powranna, Tasmania. No. 54631: Cream and cheese scale; McMillan and Frederic, Ltd, Stratford. No. 57098: Teat-cup; J. H. Bishop and C. W. Nearler, Morrinsville. No. 57312: Steel fence-post; Rylands Bros., Ltd., Newcastle, N.S.W. No. 55153: Mole drain-plough; H. R. Jensen, Whakaronga. No. 56325: Flax-dressing machine; W. R. Aicken, Martinborough. No. 57424: Fence-dropper; S. E. Page, 27 Chancery Lane, London W.C. 2, England. No. 57489: Tractor loading-attachment; H. F. Lessmann, Des Moines, U.S.A.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office; or fees may be remitted by Post Office order or postal note.

CLASSIFICATION OF CATTLE IN NEW ZEALAND.

FOLLOWING are particulars of cattle in the Dominion (including boroughs) for the last two years' enumeration, as compiled by the Census and Statistics Office:—

	Number on 31st Jan., 1925.	Number on 31st Jan., 1926.
Bulls two years old and over, for stud—		
For beef purposes	12,679	12,908
For dairy purposes	47,141	45,945
Steers two years old and over*	405,768	394,547
Steers and bulls one and under two years old	189,801	169,249
Cows and heifers two years old and over, for dairying—		
In milk	1,178,504	1,181,441
Dry	124,625	122,415
Other cows and heifers two years old and over	518,284	535,273
Heifers one and under two years old	441,510	401,013
Calves (heifer, steer, and bull) under one year old	552,164	589,695
In boroughs, &c.	33,268	†
Totals	3,503,744	3,452,486

* Including bulls not kept for stud purposes.

† Included in classified figures above.

WEATHER RECORDS: DECEMBER AND CALENDAR YEAR 1926.

Dominion Meteorological Office.

GENERAL SUMMARY FOR DECEMBER.

RAINFALL during December was above the average over most parts of the Dominion, but strikingly deficient in other districts. The falls were excessive at times in many localities. Thus, while Auckland and other places near had two and a half times their usual fall, Hamilton had less than the usual average for December. The same striking contrast is seen in comparing the total quantities in Poverty Bay and Hawke's Bay, Gisborne having two and a half times its usual average and Napier 60 per cent above the usual, while other places inland had less than the average. Again, Dunedin had double its usual average quantity, while Invercargill had about half. Rainfall was below the average on the west coast of the South Island and in some parts of the North Island.

Southerly winds and cold changeable conditions prevailed during the first week of the month, owing to the passage of a storm eastward of New Zealand. A barometric pressure of 28.97 in. was reported from the Chatham Islands on the morning of the 3rd, while barometric pressure in New Zealand averaged $\frac{1}{2}$ in. higher. On the 11th a westerly disturbance passed in the South, and accounted for strong north-west winds. Another westerly disturbance passed in the South on the 20th, and two disturbances were in evidence about Christmastide, one in the North accounting for very heavy downpours. These two disturbances neutralized each other, however, so far as wind was concerned, but together accounted for mild, dull, and wet weather generally.

Conditions were backward on the whole, and haymaking was greatly interfered with in many parts of the country.

RAINFALL FOR DECEMBER AND CALENDAR YEAR 1926 AT REPRESENTATIVE STATIONS.

Station.	December.				Calendar Year.	
	Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.	Total Rainfall, 1926.	Average Rainfall.
<i>North Island</i>						
	Inches.		Inches.	Inches.	Inches.	Inches.
Kataia	1.28	7	0.62	3.28	58.97	50.87
Russell	3.52	8	1.98	2.05	65.22	49.79
Whangarei	3.16	8	0.70	2.49	76.15	60.24
Auckland	6.39	16	2.31	2.84	63.55	44.18
Hamilton	2.87	16	0.64	3.72	58.74	50.36
Kawhia	3.24	12	0.80	3.21	63.92	52.70
New Plymouth	4.14	14	1.10	4.33	67.84	60.18
Riversdale, Inglewood	7.03	23	1.70	7.43	116.06	104.48
Whangamomona	5.73	12	1.43	5.98	91.05	79.50
Tairua	10.86	8	1.44	4.30	74.05	65.82
Tauranga	6.89	13	1.85	3.47	58.14	53.10
Maraekaho Station, Opotiki	2.76	14	0.46	2.82	50.84	50.77
Gisborne	5.88	17	1.56	2.16	34.79	40.94
Taupo	1.43	7	0.50	3.66	45.53	45.20
Napier	3.46	13	1.28	2.30	20.89	36.41
Maraekakaho Station, Hastings	5.45	16	1.81	2.21	25.01	31.81
Taihape	2.38	12	0.65	3.42	40.54	40.01
Masterton	4.02	17	0.95	2.80	38.61	38.71
Patea	5.69	11	1.40	3.35	54.62	44.05
Wanganui	2.81	11	0.73	2.63	42.12	36.86
Foxton	3.10	5	1.50	2.54	43.84	31.88
Wellington	3.79	12	0.91	3.29	42.38	48.21

RAINFALL FOR DECEMBER AND CALENDAR YEAR 1926—*continued.*

Station.	December.				Calendar Year.	
	Total Fall.	Number of Wet Days.	Maximum Fall.	Average December Rainfall.	Total Rainfall, 1926.	Average Rainfall.
<i>South Island.</i>						
	Inches.		Inches.	Inches.	Inches.	Inches.
Westport	5·10	16	1·56	6·60	67·51	78·27
Greymouth	5·61	14	1·15	8·95	89·12	104·13
Hokitika	7·56	13	2·15	10·70	118·72	116·59
Ross	8·44	11	2·51	12·04	140·26	136·86
Arthur's Pass	16·22	13	4·10	12·02	205·16	156·61
Okuru	12·53	12	4·14	11·73	150·37	148·32
Collingwood	12·56	14	3·52	8·01	110·47	99·81
Nelson	4·10	11	1·20	2·69	36·96	37·84
Spring Creek	4·80	13	1·53	1·93	34·22	30·31
Tophouse	6·65	14	2·02	5·00	70·25	60·78
Hanmer Springs	3·54	16	0·75	3·26	44·30	40·82
Highfield, Waiau	2·65	11	0·48	2·51	28·80	33·38
Gore Bay	3·47	13	0·65	2·12	21·12	31·63
Christchurch	3·55	12	1·39	2·06	23·84	25·30
Timaru	4·02	11	1·30	2·41	23·70	22·78
Lambrook Station, Fairlie	4·13	12	1·41	2·33	26·41	25·09
Benmore Station, Clearburn	2·02	11	0·64	1·77	30·34	24·15
Oamaru	4·69	11	1·62	2·15	29·46	21·82
Queenstown	2·31	10	0·76	2·55	33·67	30·53
Clyde	1·84	10	0·50	1·79	17·72	15·23
Dunedin	7·08	16	1·41	3·48	44·93	36·96
Wendon	2·35	9	0·88	2·95	32·89	30·57
Gore	2·33	13	0·51	3·41	34·42	35·17
Invercargill	2·16	14	0·52	4·26	47·24	45·98
Puysegur Point	6·72	14	1·36	6·63	95·90	83·01

—D. C. Bates, Director.

Commercial Poultry-farming—The Chief Poultry Instructor remarks as follows in his annual report for 1925-26: "A gratifying feature at the present time in connection with the industry is the increasing number of large plants established throughout the country, and which are proving profitable undertakings to their owners. A few years ago large commercial plants were few and far between. Now there are many, ranging from 600 to 1,000 bird-capacity, while in some cases plants are carrying upwards of 3,000 laying-birds. The advance made in this connection is almost entirely due to the improved type of laying-bird now available, and the advanced knowledge relative to the breeding, housing, feeding, and general management of poultry."

Grass-grub and Tree Nurseries.—Damage by the grass-grub again occurred in South Island nurseries of the State Forest Service during the 1925-26 season, and efforts were made to prevent attacks and protect tree crops. Experiments were carried out with the aim of arresting the flights of beetles in the vicinity of seedling crops and thus preventing egg-deposition on the area. Screens of plain calico provided with a drowning-trough along the base and of calico covered with an adhesive mixture were placed as barricades to the prevailing direction of flight adjoining badly affected grassland. Negative results, however, were obtained.

Cereals respond well to superphosphate. Root crops require mixtures of slow and rapidly acting phosphate. Green forage crops are benefited by nitrogenous fertilizers in addition to phosphate.

ANSWERS 'TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

GREASY HEEL IN HORSES.

"SUBSCRIBER," Ashburton :—

I have a draught gelding with greasy heels, all four legs being affected. The heels have broken out in open sores and there is some discharge. The animal has also gone lame. I have clipped the hair short, and am bathing daily with a strong disinfectant solution. Is this correct? If not, kindly advise me as to treatment. Also, is the trouble infectious?

The Live-stock Division :—

In regard to the treatment you describe, there is a possibility that you are using too strong a solution, and the treatment indicated below would be advisable. In this connection it is well to know that except in very slight cases a cure is extremely difficult to effect. But even if the animal is badly affected the treatment suggested will have the effect of keeping the trouble in check and lessening the objectionable condition. As the disease is primarily constitutional, internal as well as external treatment is necessary. It is therefore advisable to give an occasional dose of physic, such as an aloes ball in a dose of from 4 to 6 drachms, according to the size of the horse. Suitable external treatment is to clip all the hair from the heels and fetlocks and liberally apply the following dressing once daily to affected parts. Zinc sulphate, 2 oz; Bol Armen, 1½ oz. To this should be added a quart of water, and the mixture well shaken before use. Any chemist will supply this. Care must be taken to keep the horse as much as possible out of wet places, and if the animal is standing in a stable it is essential to keep the floor clean and free from urine and dung. As already stated, the disease is primarily constitutional, and therefore if other animals in the same stable are kept properly groomed and clean there is little likelihood of their becoming affected unless predisposed towards the trouble.

TREATMENT FOR KING-COUNTRY LAND.

J. K. C. BAINES, Feilding :—

On my farm at Propio, King-country, the grass has begun to show signs of exhaustion. I top-dress annually with basic slag, but the response is very weak. Could you advise me as to what manures are best suited for this light land, and the quantity to use to obtain the best results? I have recently ploughed up 50 acres with the intention of grassing down afresh. Would you kindly specify a good mixture to use, and inform me whether turnips or rape would be best sown first?

The Fields Division :—

Generally speaking, super gives better results on light porous soils than does slag, and for general purposes we would recommend you to use a mixture of two parts super and one part carbonate of lime, at the rate of 4 cwt. per acre. Super alone does well, but you would probably get rather better results with a little lime added. Alternatively, you could apply ½ ton of lime every six or seven years and use super annually. Autumn application is usually best, as it promotes early spring growth. Before resowing the land to grass it would be good practice to take one crop of swedes, then rape, working the surface lightly when the rape is fed off preparatory to sowing grass. Sheep could be used to tread in the seed, as these soils are badly in need of consolidation. If a little bonedust or blood-and-bone were used in the rape-manure it would help the young grass considerably. A suitable mixture for permanent pasture for sheep with a few cattle would be as follows: Italian rye-grass, 3 lb.; perennial rye-grass, 10 lb.; cocksfoot (Akaroa), 12 lb.; crested dogtail, 3 lb.; timothy, 1 lb.; *Danthonia pilosa*, 1 lb.; cow-grass (colonial), 2½ lb.; white clover (colonial), 1½ lb.; subterranean clover, ½ lb.;

Lotus major (colonial), $\frac{1}{2}$ lb. : total, $34\frac{1}{2}$ lb. per acre ; approximate cost per acre, £1 17s. cash. With judicious top-dressing and careful management this should give you a high-class permanent turf.

FOUL-IN-THE-FOOT.

E. H. L., Mahakipawa :—

Would you please give me some information as to treatment of lameness in a cow? The trouble commenced last summer with an inflamed swelling of the coronet of one forefoot. The wall of the hoof, about an inch down from the coronet, cracked and opened, and eventually the swelling burst, the pus being exuded through the hole in the hoof. It has healed several times, only to burst again.

The Live-stock Division :—

This trouble is commonly known as "foul-in-the-foot," and is caused by micro-organisms gaining entrance through abrasions, wounds, &c. The condition is most often met with in animals that have been standing in mud and filth, but sometimes arises through bruises sustained on hard stony ground. The following treatment is recommended : Examine the sole and between the claws for any wounds, &c. ; remove any superfluous horn, especially at the toe ; stand the foot in a bucket of warm water to which a little Jeyes and a handful of washing-soda have been added ; thoroughly cleanse the foot and then apply a bran poultice, leaving this on overnight. The bathing and poultices should be continued until the discharge ceases. Then apply to the wound a pack of cotton-wool or tow soaked in a weak solution of bluestone, keeping the pack in place with a bandage applied round the hoof-head and between the claws. The animal should be kept in a clean, dry paddock.

MILDEW ON LETTUCE.

A. SEUX, Poroti :—

Will you kindly give me information as to treatment and effective preventive measures for mildew on lettuces?

The Horticulture Division :—

Mildew infection of a lettuce crop is best treated by lifting diseased plants and carefully destroying them. Where heavy cropping is carried out without much rotation, all plant-waste should be burnt to avoid soil-infection. In difficult cases the soil should be given a dressing of lime, and crops immune to this disease should be planted for a season or two.

PROLAPSE OF RECTUM IN YOUNG PIGS.

C. EMERY, Rotokohu :—

About a week after weaning a litter I found two of the little pigs with part of their bowels projecting from behind. I put the parts back, with a stitch to keep them in place, but two weeks after they came out again. About a month after the same thing happened to two more. The food they have had since weaning is skim-milk—nothing else—and their bowels are working very freely. Would you please tell me the cause of this complaint and a cure for it?

The Live-stock Division :—

Prolapse of the rectum is frequently a complication of severe diarrhoea or constipation, particularly when either of these complaints is accompanied by excessive straining. This disease is favoured by weakness, with relaxation or paralysis of the muscle surrounding the anus. Treatment consists of cleaning up the part and replacing it by steady pressure of the hand or finger. Raising the hind quarters slightly and injecting small quantities of water and olive-oil greatly assist. Sometimes replacement has to be repeated. In your case the trouble appears to be due to diarrhoea, and in this connection it is noted that you are feeding solely with skim-milk. Although skim-milk is frequently the only diet given to pigs, it provides insufficient nourishment and should be supplemented by pea-meal, bean-meal, blood-meal, or linseed-meal.

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No. 2.

THE GRASSLANDS OF NEW ZEALAND.

REGRASSING EXPERIMENTS ON DETERIORATED HILL COUNTRY IN WHANGAMOMONA COUNTY, 1925 AND 1926.

E. BRUCE LEVY, Agrostologist, Biological Laboratory, Wellington.

DURING the past three years some 347 acres of hill country in Whangamomona County have been burnt and sown with experimental seed mixtures by the Department of Agriculture. The sowings have been made on different types of primary forest and secondary growth, on different soil and slope aspects, and on areas where varying systems of farm-management were practised.

The first of these sowings, made in 1924, are recorded in the *Journal* for August of that year. In the sowings made in 1925 the mixtures were considerably altered as a result of detailed analytical work on the plots sown the previous autumn. In 1924 the cost of the mixtures was not taken into consideration, but in 1925 the use of the most economical mixtures, based on work done on the previous year's sowings, was the main objective. Certain species sown in 1924 were outstanding, and these were made the base upon which to construct the most economical mixture. Species regarding which there was a doubt as to their suitability for the country were considerably reduced in quantity, while others were eliminated altogether.

At the end of the first year the outstanding questions to be definitely proved were the following :—

- (1.) Are cocksfoot and perennial rye-grass worth while?
- (2.) Will danthonia come in naturally (without being sown artificially), provided sufficient feed from other more-cheaply-establishing species is secured to keep stock working on the area, in order that secondary growth may be so effectively controlled that light can reach the ground surface? One cannot but think that if only all the hill country can be kept open to the light danthonia will ultimately come in and take charge. The question is whether we can get other cheaper-establishing species that will immediately pay for their sowing, and that will keep going long enough to enable such development to take place.

(3.) Is the inclusion of small quantities of seed of *Danthonia pilosa*, *Lotus major*, *paspalum*, *Poa pratensis*, subterranean clover, yarrow, and *Lotus hispidus* justified on the score that these plants—so successful in other parts of New Zealand—will come on in later years if some seed is sown, and spread by their own inherent capacity to establish through reseeding or by their capacity to tiller out vegetatively? To rely on any of these species to form an early sward seems quite futile, in the Taranaki back-country at least.

The outstanding success of brown-top and crested dogtail as good establishers and rapid sward-formers determined us to make these two species the basis of the mixtures, which determination has not been modified after three years' close examination of results.

The 1925 Trials.

The different seed mixtures used in the 1925 trials are given in the tables which follow:—

Table 1.—General Mixtures for Secondary Burns, 1925: Each Plot 1 Acre.

Mixture-numbers	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Perennial rye-grass .. ..	..	..	4	4	4	4	2	..	..	..
Cocksfoot .. ..	..	..	3	3	3	3	6	10	..	..
Crested dogtail	4	4	4	4	4	4	4	4	4	4
Brown-top	2	2	2	2	1	1	1	1	2	3
<i>Danthonia pilosa</i> .. ..	..	3	..	3	..	3	3	3	3	..
<i>Paspalum</i>	1	1	1	1	1	1	1	1	1	..
White clover	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	..	..
<i>Lotus major</i>	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1
<i>Lotus hispidus</i>	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	..
Subterranean clover ..	2 OZ.	2 OZ.	2 OZ.	2 OZ.	2 OZ.	2 OZ.	2 OZ.	2 OZ.	2 OZ.	..
Yarrow	1 OZ.	1 OZ.	1 OZ.	1 OZ.	1 OZ.	1 OZ.	1 OZ.	1 OZ.	1 OZ.	..
Wild white clover .. ..	..	..	..	..	..	..	..	..	1	..
Rattail .. ..	..	..	..	..	..	..	..	..	1	..
Chewings fescue .. ..	..	..	..	..	..	..	..	..	2	..
Total amount per acre	8.7	11.7	15.7	18.7	14.7	17.7	18.7	20.2	15.2	8

The first four mixtures in the above table are designed to give information regarding the need or otherwise of including *danthonia* in the mixture, and whether the inclusion of rye-grass and cocksfoot help materially in the formation of the ultimate sward. Mixtures 5 and 6 were included for country somewhat above the average, or where top-dressing with artificial manures might be carried out. Whether or not it is necessary to include *danthonia* is again tested here. Mixtures 7 and 8 contain more cocksfoot for the purpose of giving this grass a further trial. Mixture 9 contains the base of finer and harder grasses, to which wild white clover, rattail, and Chewings fescue have been added. Mixture 10 contains the three outstanding species that up to the present are promising best on the slightly more fertile soils and where a certain amount of top-dressing is practicable.

Table 2.—*Mixtures for Primary Forest Burns: Each Plot $2\frac{1}{2}$ Acres.*

Mixture-numbers	1.	2.	3.	4.
	lb.	lb.	lb.	lb.
Cocksfoot	15	8	4	..
Perennial rye-grass .. .. .	..	6	6	..
Italian rye-grass	2	2	2	2
Crested dogtail	4	4	4	4
Brown-top	$\frac{1}{2}$	1	2	3
Danthonia pilosa .. .. .	..	1	2	3
Paspalum	1	1	1	1
White clover	1	1	1	1
Lotus major	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
Lotus hispidus .. .. .	..	..	..	1
Subterranean clover	2 OZ.	2 OZ.	2 OZ.	2 OZ.
Yarrow	1 OZ.	1 OZ.	1 OZ.	1 OZ.
Total amount per acre	24.2	24.7	22.7	15.7

In the above series of plots (Table 2) the trial centres largely on a comparison of cocksfoot in varying amounts associated with brown top and Danthonia pilosa, these also in varying amounts. Where the cocksfoot is highest in amount the brown-top and the danthonia are low or absent altogether, and where the cocksfoot is reduced and absent these two hardier grasses are increased in amounts. Each mixture costs approximately the same—approximately 35s. per acre. None of these mixtures is intended to be ideal for the country, but is sown specially for careful comparative analytical work on the species themselves.

Table 3.—*Crested Dogtail, Brown-top, and Lotus major Trials: Each Plot $\frac{1}{2}$ Acre*

Mixture-numbers	1. 1A	2. 2A.	3. 3A.	4. 4A.	5. 5A	6. 6A	7. 7A	8. 8A	9. 9A.	10. 10A.	11. 11A	12. 12A.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Crested dogtail ..	20	..	..	4	15	..	..	4	10	..	..	2
Brown-top ..	..	5	$3\frac{1}{2}$	$2\frac{1}{2}$	..	$3\frac{3}{4}$	3	2	..	$2\frac{1}{2}$	2	$1\frac{1}{2}$
Lotus major ..	..	..	$1\frac{1}{2}$	$1\frac{1}{2}$	..	..	$\frac{3}{4}$	$\frac{3}{4}$	..	..	$\frac{1}{2}$	$\frac{1}{2}$
Total amount per acre	20	5	5	8	15	$3\frac{3}{4}$	$3\frac{3}{4}$	$6\frac{3}{4}$	10	$2\frac{1}{2}$	$2\frac{1}{2}$	4

These small plots were sown in duplicate, one lot being sown in the ordinary way after the burn, and the other (in each case the A plot) top-dressed with 1 cwt. of superphosphate per acre at the time of seeding. Weak turf as well as burnt patches was sown with these mixtures. It was thought that by increasing the fertility of the surface layer of soil, upon which the seed germinates, a more ready establishment would be effected.

The mixtures of Table 3 fall into three groups. In each of the first four mixtures, 20s. worth of seed per acre is sown; in each of the middle four, 15s. worth of seed per acre; and in each of the last four, 10s. worth. When the mixtures were sown crested dogtail was 1s. and brown-top and Lotus major 4s. per pound.

NEW INTRODUCTIONS AND LESS COMMONLY USED SPECIES.

In addition to the foregoing, other species than those more regularly used were tested. A mixture consisting of the following fifty-three species was sown at the rate of approximately 60 lb. per acre: Tall fescue, meadow-fescue, hard fescue, sheep's fescue, various-leaved fescue, fine-leaved sheep's fescue, Chewings fescue, Wakeman's fescue, red fescue, sand fescue, *Festuca decolorans*, *Scleropoa rigida*, tall oat-grass, golden oat-grass, prairie-grass, *Bromus inermis*, *Bromus patulus*, *Bromus racemosus*, *Bromus erectus*, *Bromus polyanthus*, *Bromus pendulus*, *Bromus macrostachys*, sweet vernal, Yorkshire fog, red-top, paspalum, ratstail, yarrow, chicory, Tambootie grass, *Phalaris canariensis*, *Phalaris arundinacea*, *Phalaris caroliniana*, *Phalaris paradoxa*, *Poa anceps*, *Poa nevadensis*, *Poa Astonii*, *Poa nemoralis*, serradella, *Danthonia semiannularis*, strawberry-clover, Lotus corniculatus, English trefoil, *Melilotus alba*, *Melilotus arvensis*, Hubam clover, *Medicago arborea*, snail clover, elephant-eared mustard, haresfoot trefoil, suckling-clover, kikuyu (planted), *Triodia decumbens* (planted).

RE-ESTABLISHMENT OF PASTURE AND PASTURE MAINTENANCE COSTS.

Experiments were initiated towards determination of cost of bringing deteriorated country back and of maintaining that country over a period of years. It is not so much the initial regrassing costs connected with the bringing back of the country that determines whether or not the proposition is economical. The determination of the maintenance costs is an essential prerequisite to the formulation of any plan for the economic working of the country. One-sheep country where the maintenance costs are high is an entirely different proposition from one-sheep country where the maintenance costs are low.

This work is not a matter of small plots, but entails whole paddocks, a fairly large expenditure of money, and exact records of incomings and outgoings so far as the particular area being studied is concerned. Up to the present the work has been attempted co-operatively with farmers, but it would appear that the control of whole farms for this purpose will be necessary before really satisfactory results can be secured.

LOCATION AND DESCRIPTION OF AREAS SOWN IN 1925.

Table 4

NOTE—Except where otherwise indicated the mixture-numbers in third column refer to Table 1

Area on Property of	Type of Country.	Mixtures used.	Remarks.
F. Coxhead, Tahora ..	Patchy bracken fern, on westerly aspect	1, 2, 3, and 4	Fairly good burn; seed sown almost immediately after burning.
Claude Carter, Tahora .	Wineberry, bush-lawyer, soft fern, bracken, and hard fern	7	Cost of regrassing and maintenance experiment; 30 acres burnt and sown.
E. B. Robertson, Tahora ..	Bracken and manuka. Manuka felled, and area top-dressed in 1924 and 1925 after seed sown	6	To compare with remainder of paddock that is being brought back by top-dressing alone. No burning of cut manuka and no sowing of seed. ■

AREAS SOWN IN 1925—*continued.*

Area on Property of	Type of Country.	Mixtures used.	Remarks.
J. Selby, Tahora	Hard-fern patches on hillside run predominantly to danthonia	3	On this area certain hard-fern patches burnt but not sown. Object of experiment is to test whether sowing of burnt patches situated in danthonia-dominant pasture is at all necessary.
J. Ostler, Kohuratahi	Hard-fern patches; N.E. slope	5 and 6	Danthonia spreading throughout area. Object of experiment to test out whether it is necessary to include danthonia in mixture when this grass is once well established on area. Patches burnt early in February, but not sown until early April
J. Ostler, Kohuratahi	Stunted bracken; S.W. slope	1 and 2	Sown almost immediately after burning.
A. Bottomley, Whangamomona	Bracken and manuka; easterly slope	1, 2, 5, and 6	Owing to poor and patchy nature of burn, and difficulty of marking out plots, these mixtures were mixed together and sown as one plot.
J. McCluggage, Whangamomona	Hard fern, bracken, and slips; very steep; S.W. slope	1, 2, 3, 4, 9, 10, and 11	Good burn secured; area sown almost immediately after the burn.
A. Coxhead, Whangamomona	Hard fern and bracken; N.E. slope	1, 2, 3, 4, and 11	Areas burnt early in February, not sown until early in April
A. Coxhead, Whangamomona	Hard fern	All Table 3	Area sown soon after being burnt
Murphy Bros., Aotuhia	Wineberry and bracken, various aspects	2 and 6	10 acres of each mixture. Cost of regrassing and maintenance experiment.
Murphy Bros., Aotuhia	Primary forest burn, S.E. and W. slopes	All Table 2	Good clean burn; burnt about Christmas-time, grass sown first week in April.
A. McCluggage, Pohokura	Bracken and hard fern; N. and W. slopes	1, 2, 3, and 6	Sown soon after being burnt.
E. J. Wilde, Pohokura	Hard fern and bracken; N.W. slope behind homestead	1 and 2	Good burn; sown soon after burning
E. J. Wilde, Pohokura	Bracken and water-fern; up from wool-shed	3	Good burn, sown almost immediately after burning
A. J. Stonewigg, Te Wera	Manuka, hard fern, and bracken; various slopes	1, 2, 3, 9, and 11	Manuka and hard fern moderately good burn. Where certain of the manuka was winter-cut among bracken and water-fern, extremely difficult to get good burn.
A. J. Stonewigg, Te Wera	Manuka and hard fern; N.E. and N.W. slopes	All Table 3	Fairly good burn; seed sown soon after burning.
H. Mayo, Strathmore	Bracken and manuka, N.E. slope	1, 2, 3, and 4	Rather poor burn, in many places thick mass of dead bracken left unburned on ground.

AREAS SOWN IN 1925—*continued*.

Area on Property of	Type of Country.	Mixtures used.	Remarks.
Areas outside Taranaki back-country also sown.			
Jepson Bros., Otaki Forks	Hard fern, water-fern, and bracken; S.E. slopes	1, 2, 3, 4, 5, 6, 7, 8, 9, and 10	Fairly good burn, but rubbly nature of country prevented access of hot fire to rhizomes of hard fern.
Corrigan Bros., Otaki Forks	Water-fern and wineberry—secondary log fire; N.W. slope	1, 2, 3, 4, 5, and 6	Owing to wet season very poor cleaning-up burns secured.
C. Morel, Murchison	Bracken fern; W. slope	1, 2, 3, 4, 5, 6, 7, 8, 9, and 10	Fairly good burn.

The season of 1925 was not a particularly good one for surface-sown seed. After the fine spell in early February little good burning weather was experienced until late in March. Most of the foregoing plots were sown early in April, but some not until rather late in April—too late to get a really good take.

The sowings of 1925 in the aggregate cover 140 acres of hill land, and the areas sown are representative of very large tracts of hill country throughout New Zealand.

Experimental Sowings of 1926.

In the autumn of 1926 additional areas were burnt and sown, the objective in these latter sowings being more or less to duplicate certain of the earlier ones so as to obtain fresh material for analytical work. The general mixtures for secondary burns were modified to some extent, but the general base of crested dogstail, brown-top, white clover, and Lotus major was retained much as in the general sowings of 1925. Following is a tabulation of the general mixtures used for secondary burns, each plot being 1 acre or more according to burn and aspect:—

Table 5.—General Mixtures for Secondary Burns, 1926.

Mixture-numbers	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Crested dogstail ..	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2
Brown-top ..	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3
White clover ..															1					
Lotus major ..																				
Lotus hispidus ..																				
Subterranean clover																				
Yarrow ..	1 oz.	1 oz.	1 oz.	1 oz.	1 oz.	1 oz.			1 oz.	2 oz.	2 oz.	2 oz.	1 oz.	2 oz.	2 oz.	2 oz.	2 oz.	2 oz.		1
Cocksfoot ..	2	3	4	6	8				3				3							3
Perennial rye-grass ..	2	2	2	2	2	2	2						4							
Danthonia pulosa ..		4	3	2	1	1	1						1	1	1	1		2		
Paspalum ..			1	2	3	4	1		1	1	1	1	1	2	4	4	1			
Wild white clover ..																				
Rhenish tall fescue ..								6									4			
Chewings fescue ..									4								6	6	4	
Hard fescue (No. 1) ..										4										
Sheep's fescue (No. 2) ..											4									
Golden oat-grass ..																				
Poa nemoralis ..																				4
Italian rye-grass ..																				
Total amount per acre	9.8	16.3	16.8	17.8	19.8	22.3	12	12	14.8	13.8	13.8	13.8	17.8	12.1	13.3	13.3	18.8	13.8	15.7	14.5

No. 1 mixture in this table may be regarded as the base of the general mixtures, the first four species in the list—crested dogstail, brown-top, white clover, and *Lotus major*—together with perennial ryegrass, being the outstandingly important species for any mixture on secondary-growth country. Where no danthonia is established on the country, however, this also should be included as a basic species.

Mixtures 2 to 6 give differential sowings of cocksfoot, danthonia, and paspalum in addition to the base. These plots are particularly required for analytical work, more especially in testing once again whether cocksfoot should not be entirely eliminated from secondary-growth mixtures, and whether danthonia will spread sufficiently from very little seed sown or whether a heavier seeding is necessary.

Mixtures 7 and 8 form a test of wild white clover against the ordinary New-Zealand-grown white clover.

Mixtures 9 to 12 provide a trial of fescues and odd additional grasses specially secured from Messrs. Webb and Son, Stourbridge, England. The Rhenish tall fescue is not open to the disadvantages of the ordinary tall fescue, inasmuch as it is considered much more palatable to stock.

Mixture 13 is a general mixture for secondary-growth burns on the slightly better country, or where top-dressing is being systematically carried out. This mixture is specially sown for comparative analytical work in connection with top-dressing trials—top-dressing of weak turf, hard fern, bracken fern, &c., as against the burning and sowings of these growths.

In mixture 14 subterranean clover has been increased, and in mixtures 15 and 16 larger quantities of wild white clover and ordinary New-Zealand-grown white clover are being tested.

In mixtures 17 to 19 Chewings fescue is included as a dominant for hard surfaces and steep bluffs.

The primary-forest-burn mixtures of 1926 were similar to those sown in the previous year, with the exception of certain fescues added, and are tabulated as follows:—

Table 6—Mixtures for Primary Forest Burns, 1926.

Plots 1-6, each 2½ acres; plot 7, 5 acres.

Mixture-numbers	1.	2.	3	4	5.	6.	7.
	lb.	lb	lb.	lb.	lb	lb.	lb
Cocksfoot	15	8	4	..	8	4	6
Perennial ryegrass .. .. .	..	6	6	..	6	6	3
Italian ryegrass	2	2	2	2	2	2	2
Crested dogstail	4	4	4	4	4	1	4
Brown-top	½	1	2	3	1	2	2
Danthonia pilosa .. .. .	..	1	2	3	1	2	2
Paspalum	2	2	2	2	2	2	2
White clover	1	1	1	1	1	1	1
Lotus major	½	½	½	½	½	½	1
Lotus hispidus	½	½	½	½	½	½	1
Subterranean clover	½	½	½	½	½	½	½
Yarrow	1 OZ	1 OZ	1 OZ	1 OZ	1 OZ	1 OZ	1 OZ
Rhenish tall fescue	6	..	..	..	..	..	4
Chewings fescue .. .. .	..	4	..	..	..	..	..
Hard fescue (No. 1) .. .. .	..	..	4	..	..	..	..
Sheep's fescue (No. 2) .. .. .	..	..	..	4	..	..	..
Total amount per acre	32.1	30.6	28.6	20.0	26.6	24.6	28.6

PURE SOWINGS OF THE COMMONER GRASSES AND CLOVERS.

Pure sowings of the commoner grasses and clovers were made so as to have on hand material for the study of each individual species, both from its establishment point of view and from the sward-forming and lasting qualities. Fourteen species or varieties were included in the trial, and 20s. worth of seed per acre of each species or variety was sown in each case. These plots are in duplicate, and the duplicate (A) plot in each case was top-dressed in the winter following the sowing with 3 cwt. basic slag per acre. The top-dressed and non-top-dressed plots are side by side in each case. This series is set out in the following table :—

Table 7.—Pure Sowings of Individual Grasses and Clovers in 1926, using 20s. Worth of Seed per Acre : Each Plot $\frac{1}{2}$ Acre.

Mixture-number.	{	1. 1A.	2. 2A.	3. 3A.	4. 4A.	5. 5A.	6. 6A.	7. 7A.	8. 8A.	9. 9A.	10. 10A.	11. 11A.	12. 12A.	13. 13A.	14. 14A.
Perennial rye-grass ..		21/-	..	..	..	..	..	..	..	..	..	..	..	..	..
Akaroa cocksfoot ..		..	20/-	..	..	..	..	..	..	..	..	..	..	..	..
Danish cocksfoot ..		..	..	20/-	..	..	..	..	..	..	..	..	..	..	..
Crested dogstail ..		..	..	..	20/-	..	..	..	..	..	..	..	..	..	..
Brown-top ..		..	..	..	..	20/-	..	..	..	..	..	..	..	..	..
Danthoma pilosa ..		..	..	..	..	..	20/-	..	..	..	..	..	..	..	..
Paspalum ..		..	..	..	..	..	..	20/-	..	..	..	..	..	..	..
Chewings fescue ..		..	..	..	..	..	..	..	20/-	..	..	..	..	..	..
White clover ..		..	..	..	..	..	..	..	..	20/-	..	..	..	..	..
Wild white clover ..		..	..	..	..	..	..	..	..	..	20/-	..	..	..	..
Lotus major ..		..	..	..	..	..	..	..	..	..	..	20/-	..	..	..
Lotus hispidus ..		..	..	..	..	..	..	..	..	..	..	..	20/-	..	..
Subterranean clover ..		..	..	..	..	..	..	..	..	..	..	..	..	20/-	..
Yarrow ..		..	..	..	..	..	..	..	..	..	..	..	..	..	20/-

MIXTURES USING 20S. WORTH OF SEED PER ACRE, THE SAME AMOUNT BEING SPENT ON EACH SPECIES INCLUDED.

In this series 20s. (or approximately) per acre was spent on grasses and clovers, the same amount of money in each sowing being spent on any one species included in the mixture. The sowings were designed to give greater comparison among those species indicative of being most successful, and less comparison among those species of minor importance only.

From this series it is hoped, by careful analytical work on the turfs formed, to be able to say fairly readily just what species in any one mixture sown is giving the cheapest cover. If, for example, we find that in mixture 6 brown-top is consistently giving a greater cover than any of the other species in that mixture then we know that the 3s. 4d. spent on this seed is more justified than in the case of any of the other seeds. By this means elimination of the unprofitable species may be secured. The measuring of the exact covering-capacity of each species is, of course, not a matter of a year or two's trial. Many years' constant work is necessary to allow for the rearrangement and adjustment of each species according to the habitat. A record from the initial sowing onwards should certainly ultimately ensure the minimum of waste and the maximum of efficiency in mixture formulas. As in the foregoing series (Table 7) these plots are in duplicate, and the duplicate (A) in each case has been top-dressed with 3 cwt. of basic slag per acre. This series is set out in the following table :—

Table 8.—Same Amount spent on each Seed included in Mixture Each Plot
1/2 Acre

Mixture-numbers	1. 1A.	2. 2A.	3. 3A.	4. 4A.	5. 5A.	6. 6A.	7. 7A.	8. 8A.	9. 9A.	10. 10A.	11. 11A.	12. 12A.
Brown-top ..	20/-	10/-	6/8	5/-	4/-	3/4	1/-	2/6	2/3	2/-	1/9	1/8
Crested dogtail	10/-	6/8	5/-	4/-	3/4	3/-	2/6	2/3	2/-	1/9	1/8
Lotus major	6/8	5/-	4/-	3/4	3/-	2/6	2/3	2/-	1/9	1/8
White clover	5/-	4/-	3/4	3/-	2/6	2/3	2/-	1/9	1/8
Danthonia pilosa	1/-	3/4	3/-	2/6	2/3	2/-	1/9	1/8
Paspalum	3/4	3/-	2/6	2/3	2/-	1/9	1/8
Lotus hispidus	3/4	3/-	2/6	2/3	2/-	1/9	1/8
Subterranean clover	3/-	2/6	2/3	2/-	1/9	1/8
Perennial rye-grass	2/6	2/3	2/-	1/9	1/8
Cocksfoot	2/3	2/-	1/9	1/8	1/8
Chewings fescue	2/-	1/9	1/8	1/8
Yarrow	1/9	1/8	1/8

PURE SOWINGS OF NEWLY INTRODUCED SPECIES.

The following new species were secured during the year and sown on two areas: Shore bent (*Agrostis maritima*), smilo (*Oryzopsis miliacea*), sweet-grass (*Panicum laevifolium*), *Melica Californica*, *Danthonia Californica*, wallaby-grass (*Danthonia semiannularis* var.).

LOCATION AND DESCRIPTION OF AREAS SOWN IN 1926.

Table 9

NOTE.—Except where otherwise indicated the mixture-numbers in the 12 column refer to Table 5.

Area on Property of	Type of Country	Mixtures used	Remark
W. Gill, Whangamomona	Hard fern and weak turf infested with pipiriri; E. slope	1-17 1-14 (Table 7) 1-12 (Table 8)	Area hard- and close-grazed prior to burning and sowing. Cleaned up whole face (approximately 36 acres) for cost - of - maintenance trial. Good deal of hard-fern rhizome not killed by fire. Most of paddock top-dressed with slag.
A. Coxhead, Whangamomona	(1) Hard-fern patches (2) Hard-fern patches, various slopes (3) Bracken fern mainly, S.E. slope	1-12 (Table 8) 1-9, 15 and 16 13	Early good burn. Early good burn, no top-dressing with slag. Area of 4 acres sown. Top-dressed in 1925 among standing bracken. So little impression made by stock on bracken that decided burn and sow. Top-dressed in 1926 after seeding.
J. Anderson, Whangamomona	(1) Heavy and sparse manuka and bracken mainly, with some hard fern; various slopes (2) Bracken and manuka ridge; E. and W. slopes	1, 2, 3, 4, 5, 6, 14, 15, 16, and 18 1-12 (Table 8)	Good burn; plots not top-dressed. Duplicate plots top-dressed.
J. McCluggage, Whangamomona	(1) Bracken mainly, on steep face; N.E. slope (2) Bracken and hard fern	9, 10, 11, and 12 7, 8, 14, 15, and 16	Very steep face; fairly good burn. Plots not top-dressed. Each plot 2 1/2 acres. Moderately good burn, no top-dressing.

AREAS SOWN IN 1926—*continued.*

Area on Property of	Type of Country.	Mixtures used.	Remarks.
J. McCluggage, Whangamomona— <i>continued.</i>	(3.) Hard-fern patches..	13	Burnt patches within top-dressed paddock in order to compare with control of hard fern by top-dressing without burning and sowing.
J. Ostler, Kohuratahi ..	(1.) Wineberry, tall bracken, and <i>Dicksonia</i> tree-fern, all felled prior to burning; ridge, E. and W. slope	7, 8, 9, 13, and 14	Fair burn; seed sown soon after burning; no top-dressing.
	(2.) Hard-fern patches ..	13	Burnt patches within top-dressed paddock.
A. Perry, Whangamomona	(1.) Young hard-fern patches; various slopes	13 and 14	Hard-fern patches small, appearing after two years' crushing of bracken. Top-dressed previous winter.
	(2.) Weak turf, two years crushed from bracken; S. and N. slopes	14	Paddock top-dressed previous winter. Establishment trial after bracken crushed out.
	(3.) Hard-fern patches	..	Pure sowings of newly introduced species.
F. Burch, Kohuratahi ..	Hard-fern patches; S.E. slope	13 and 14	Good burn of patches. Within dairying-area. Top-dressed in winter following burning and sowing.
A. Bottomley, Whangamomona	(1.) Felled manuka and bracken mainly; various slopes	15 and 16	Good burn; not top-dressed.
	(2.) Hard-fern patches	13	Good burn of patches within top-dressed area.
	(3.) Hard-fern patches; W. slope	..	Patches burnt but not sown; to compare with sown portion on very hard slope where sweet vernal predominates.
	(4.) Manuka and bracken	..	Pure sowings of newly introduced species.
A. McCluggage, Pohokura	Bracken and hard fern; N. slope	13	Burnt patches within top-dressed area.
E. J. Wilde, Pohokura ..	Wineberry mainly ..	9, 14, 15, and 16	Poor burn; not top-dressed.
G. Clifton, Whangamomona	Manuka, bracken, and hard fern	13 and 14	Fairly good burn of steep hard face; not top-dressed.
Wm. Fletcher, Whangamomona	(1.) Papa slips .. (2.) Primary forest burn; N.S. and N.E. slopes	9, 10, 11, and 12 5, 6, and 7 (Table 6)	Slips two years old. Plots 5 and 6, each 2½ acres; plot 7, 5 acres. Light burn over most of area.
Murphy Bros., Aotuhia ..	Primary forest burn; N.E. slope	1, 2, 3, and 4 (Table 6)	Good burn. Each plot 2½ acres. Portion sown with turnips; portion with Japanese millet.
J. Carver, Kohuratahi ..	Bracken fern; N.E. slope	7, 8, 9, 14, and 19	Bracken burnt in spring and crushed during autumn; sown middle of April.
H. Mayo, Strathmore ..	Bracken fern; N.E. slope	20	Second fire over bracken; burnt in spring, and not sown until second week of April.

General.

Most of the plots in both years were sown during the latter half of March, and very good weather was experienced for the germination and establishment of the seed sown. A total of 123 acres was sown in 1926, thus aggregating 347 acres for the three years we have been working on the country. This area could not possibly have been burnt and sown without the hearty co-operation and assistance of the farmers themselves. In country such as Whangamomona, where good burns are difficult to secure, it is surprising how little one man can do, so far as the burning alone is concerned, during the limited number of days when burning is possible. It is only by availing oneself of the work done by the farmers concerned that a large area representative of all classes in the district can be secured. In the sowing also, where it seems imperative to get the seed on as soon after the burn as possible, the more hands on the job the better.

The writer wishes to express his appreciation to the farmers concerned; also to Mr. J. W. Deem, the Department's Instructor in Agriculture for the district, and to his assistants, Mr. D. Sidey and Mr. J. M. Smith. To the writer's own assistant, Mr. E. A. Madden, his thanks are also due for the long and strenuous hours put in while the work here referred to was in progress. For the loan of his woolshed for mixing and weighing out of seed, and for many helpful services rendered, special thanks are also due to Mr. A. Coxhead, farmer, Whangamomona.

A preliminary report (illustrated with photos) on the progress of the plots is being prepared for the March issue of the *Journal*.

(To be continued.)

OLD MOTOR-TIRES FOR FARM-IMPLEMENT WHEELS.

MR. W. J. McCULLOCH, Instructor in Agriculture, Palmerston North, writes: "Recently while taking weights on Mr. M. Martin's experimental top-dressing plots, at Rangiwhia, my attention was directed to a rather novel idea which is worth the attention of other farmers. In closely settled districts at this season of the year one often meets mowing-machines travelling along metalled roads, either from farm to farm or to other hay-paddocks on the same farm, and it is generally recognized that such travelling is damaging to the machine, shaking nuts and bolts loose, &c. The machine referred to was fitted with old motor-tires, of which there are usually a number lying about most farms nowadays. The tires are cut through in one place at right angles, and are thus easily slipped over the mower-wheels, forming a cushion tire. They are just as easily removed on arrival at the field. To fit the tire in position, one end is placed on the ground in front of the mower-wheel, and the machine moved forward, when the tire automatically drops into position round the wheel."

Travelling of Fat Lambs.—The following points are suggested by J. M. Coleman, in the *Agricultural Gazette of New South Wales*, for minimizing the loss of condition and weight of fat lambs in transport by railway: (1) Muster and draft as late as possible; (2) drive some ewes to the trucking-yards to hold the lambs together and prevent them from continually "breaking"; (3) exercise care in driving to the yards; (4) spell the lambs before trucking them; (5) handle carefully while trucking; (6) do not allow the lambs to be trucked thirsty; (7) avoid overloading the trucks.

INSECT CONTROL OF NOXIOUS WEEDS.

JOINT SCHEME INITIATED AGAINST BLACKBERRY AND OTHER SPECIES.

A VISIT was made last year to America and Europe by Dr. R. J. Tillyard, F.R.S., head of the biological branch of the Cawthron Institute, on various scientific business. One of the most important investigations undertaken was that of the biological control of pest weeds, with special reference to blackberry (*Rubus*), with which New Zealand is particularly concerned. The line of biological control proposed by Dr. Tillyard is that of the introduction of insect natural enemies of the respective weeds—a method which involves considerable contingent danger, and which therefore had hitherto been deprecated by several leading entomological authorities.

Before Dr. Tillyard's departure from New Zealand an agreement was made between him and the Director-General of Agriculture in connection with any experiments to be undertaken for the control of blackberry by insect agency, with the object of safeguarding against the introduction of species which might also attack economic plants. The conditions of the agreement were as follows:—

- (1.) No species to be forwarded from any country to New Zealand except such as are known to feed on species of the genus *Rubus* only.
- (2.) All shipments on arrival in New Zealand to be taken charge of by an officer of the Department of Agriculture, who shall examine the cages to see that they are intact and that no insects can escape from them while being forwarded to Nelson. (This would allow of broken or damaged consignments being either destroyed or their cages repaired before forwarding.)
- (3.) Dr. Tillyard to furnish to the Director-General of Agriculture an account of the life-history of each species selected for study.
- (4.) The permits granted for introduction of all *Rubus*-feeding species to be permits restricting the study and rearing of such insects to closed insectaria and cages in the Cawthron Institute grounds and laboratories.
- (5.) All such insects to be thoroughly tested within such insectaria or cages on all important economic plants, particularly introduced Rosaceae, such as apples, pears, stone-fruits, roses, &c.
- (6.) If considered necessary similar tests to be made in country of origin before shipment.

During his visit Dr. Tillyard discussed his plans very fully with Dr. L. O. Howard at Washington, Dr. G. A. K. Marshall in London, and Dr. D. A. Imms at Rothamsted, with the result that all these representative authorities signified their approval of them.

When in England negotiations were initiated by Dr. Tillyard for the organization of research into the problem of control of noxious weeds by their natural enemies. The result was the acceptance of a scheme by the Empire Marketing Board, the New Zealand Government, and the Cawthron Trust. For the purpose of this work a grant of £4,000 per annum for five years has been made, one-half to be contributed by the Board, one-fourth by the Government, and one-fourth by the Trust. The work is to be carried out under the control of Dr. Tillyard, with the approval of the New Zealand Research Council. The annual expenditure is allocated to cover the salaries and expenses of a field entomologist and assistant in New Zealand,

and an entomologist and assistant in England; half-salary of Dr. Tillyard; supplies from Europe and America; insectaries and apparatus; travelling-expenses; and miscellaneous.

A report on his tour and investigations, dated 7th January, 1926, has been furnished to the Government by Dr. Tillyard. The first section of the report, dealing with the present subject, is as follows:—

SUMMARY OF THE PRESENT POSITION AS REGARDS BIOLOGICAL CONTROL OF NOXIOUS WEEDS.

There is at present only one completed piece of research along these lines—viz., the attempt to control lantana in the Hawaiian Islands by the introduction of its natural enemies. In this case the line of attack was to try to prevent the plant from seeding. This attempt, though carried out some years ago without such safeguards as we should now deem necessary, was entirely successful. The plants left on the islands, failing to seed, gradually died out, and some blocks were burnt and cleared also. At the present time lantana is no longer a menace in the Hawaiian Islands.

A much more ambitious attempt on a larger scale is that being now carried out by the Federal Government in Australia for the control of prickly pear by insect enemies. It is perhaps too early yet to prophesy complete success for this vast enterprise, where no less than thirty millions of acres of land are involved, with an increase of the pest engulfing another million acres annually; but the latest reports indicate that a number of valuable insects have been acclimatized, and can do very fine work in destroying the pear.

As a result of my studies and inquiries in America and Europe I feel able to state definitely that there is a very good prospect of either partial or complete control of a number of pest weeds in New Zealand without exposing the country to any serious danger in other directions.

The following is a short summary of the principal insects which, in my opinion, ought to be studied in connection with biological control of pest weeds:—

Blackberry.

(1.) Insects which attack the Crown and Stem by Boring or Gall-forming.

Coroebus rubi Linn.: A Buprestid beetle. The larva does great damage to blackberry in southern Europe, up to 60 per cent. of the new stems being destroyed in some years. It does not touch raspberry or any other plant, except that occasionally it is known to attack, more or less accidentally, the long runners of the Frau Karl Druschki and similar roses. This habit would bar this insect from entry into New Zealand under clause 1 of the agreement given.* As, however, the beetle is common right through Hungary, where roses of all sorts are grown in enormous numbers for perfume, and has never been known to attack roses anywhere else except at Grasse, in France, I am of opinion that it should be given a trial. It would be one of the exceptional cases where, it seems to me, a permit might be granted for the testing of the insect under New Zealand conditions, especially

* As quoted on opposite page.—Ed.

as it is one of the few blackberry insects which does not destroy the raspberry, and in view of its great potential value in destroying blackberry.

Agrilus ruficollis Fabr.: A Buprestid beetle found in North America. Smaller and less destructive than *Coroebus rubi*, but does considerable damage at times. Attacks blackberry, raspberry, dewberry, but not roses or any other plants. A provisional permit has been granted for this insect, and the first consignment has been forwarded by Dr. Howard to Panama, where it was transhipped for New Zealand last month.

Bembecia marginata Harris: A rather large clear-wing moth from North America whose larva damages the crowns of blackberry and raspberry, forming galls which kill the stems. It can be controlled in raspberry by careful cutting out of the infected canes. Does not attack roses or any other plants. A vigorous insect of great potential value. A provisional permit has been granted for this insect, and the first consignment has been forwarded by Dr. Howard with that of *Agrilus ruficollis* mentioned above.

Bembecia hylaeiformis Lasp.: The smaller European representative of this genus, having a smaller larva which feeds in the same manner, but is only known to attack blackberry and dewberry. A most valuable insect, for which a provisional permit has been granted. Not found in England. Supplies will have to be obtained probably from Austria.

(2.) *Insects which attack the Twigs.*

Diastrophus rubi Htg.: A small Cynipid whose larvae form galls ranging from 2 in. to 8 in. in length on the twigs of blackberry, dewberry, and raspberry. Not known to attack any other plants, with the exception of a single record from bracken—probably an erroneous determination. Can be easily controlled on raspberry by cutting out the galls. A provisional permit has been granted for this insect. As it only occurs very locally in Europe and is not found in England, supplies will not be easy to obtain. A large number of parasites are known from this insect. When these are eliminated the damage which it is capable of inflicting on blackberry should be very considerable. The galls usually completely prevent the fruiting of the twig attacked. There are also large galls on blackberry in Europe formed by the Cecidomyiid fly *Lasioptera rubi*; but, as far as I can find out, these galls rather tend to stimulate than check the growth of the plant, the insect acting as a natural pruner. For this reason it will not be considered further at present.

(3.) *Insects which attack the Leaves and Shoots.*

The attack on these parts is to be regarded as auxiliary to the main attack on the stems. The leaves being the parts where the food-supply is formed, much weakening of the plant can be caused by a strong attack on them; but destruction of the leaves alone is not likely to succeed in controlling so vigorous a plant as blackberry.

Thyatira batis Linn. (peach-blossom moth): The name is given owing to the forewings having oval marks coloured white and pink, just like the petals of the peach-blossom. It is now known that

these markings are a natural protection to the moth while resting on blackberry, and really imitate, not peach-blossom, but blackberry-blossom. The caterpillar feeds on the leaves of the blackberry and raspberry. It can be easily controlled on the latter by a single arsenical spray, applied early in the season so as not to affect the fruit. It is common in England and all over Europe. A provisional permit has been granted for the insect, and two consignments of pupae have been sent from England. Broods are now being reared at the Cawthron Institute.

Habrosyne derasa Linn. (buff arches moth): Allied to *Thyatira batis*, but the larva has a different mode of feeding, and the pupa goes underground for the winter. The caterpillar feeds normally on blackberry, very rarely touching raspberry. Common in England and Europe. Owing to published but somewhat doubtful records of this moth having been found eating hawthorn and hazel, the supplies obtained by me in England have been left behind at Rothamsted, where Mr. Davies* has instructions to test the larva on these and other plants fully before sending it out to New Zealand.

Cidaria albicillata Linn. (beautiful carpet moth): This is a smaller geometrid moth whose larva feeds on blackberry and raspberry; also recorded from strawberry (wild), alder, and clematis by one writer (Scorer), but these records need verification. Supplies obtained by me in England this year, but left behind at Rothamsted for testing.

Tischeria marginata H.W.: A small Tineoid whose larva makes mines and blotches on the leaves. Only known from blackberry. Common in England and Europe. A provisional permit has been issued for this insect.

Notocelia uddmanniana Linn.: The larva, common in England and Europe, is a leaf-roller which attacks blackberry and raspberry. Easily controlled by arsenical spray. A provisional permit has been issued for this insect.

Schreckensteinia festaliella Hb.: A small Tineoid found in Europe whose larva feeds on the leaves of the *Rubus*. A provisional permit has been issued for this insect.

Typhlocyba tenerrima H.S.: A small leaf hopper, very rare in England and Europe, but perhaps capable of doing considerable damage. Only known to feed on blackberry. A provisional permit has been issued for this insect, but I have instructed Mr. Davies to carry out very full tests at Rothamsted before forwarding supplies.

Monophadnoides rubi Harris: A sawfly found in North America whose larva does considerable damage to the leaves of raspberry and blackberry. Easily controlled by a single arsenical spray. A provisional permit has been issued for this insect, which should prove of considerable value against blackberry.

Metallus rubi Forbes: A small sawfly from North America whose larva forms mines and blotches in the leaves of the blackberry only. Probably of considerable value. A provisional permit has been issued for this insect.

* Mr. W. Maldwyn Davies, M.Sc., appointed entomologist at Rothamsted under the scheme of research.

(4.) *Insects which attack the Flowers and Fruit.*

I have not been able to find any insect so far which is effective in attacking these parts of the blackberry. Various species of *Byturus* attack the fleshy receptacle of the fruit of species of *Rubus*, but they all seem to prefer raspberry to blackberry, and in any case they do not prevent seeding, but only make the fruit unpleasant to eat.

The Anthomyiid fly, *Phorbia rubivora* Coq., known in America as the raspberry-cane maggot, is very deadly on raspberries, but prefers them to blackberries. There may be other species of this genus which will only attack blackberry, but I have no record of them so far.

The blackberry-fly, *Pterandrus rubivorus* Coq., found in South Africa, is stated never to attack raspberry or any other fruit. But in my opinion it will be necessary to have very full tests made with this insect in its country of origin before considering its use against blackberry in New Zealand.

General Summary.

From the above it will be seen that a very strong attack can be developed by means of insects against the blackberry. The main weight of the attack must be directed towards destruction of the crowns and stems, with a subsidiary attack on the food-supply of the plant by destruction of the leaves. The weak spot of the attack is the absence of reliable species to attack the flowers and young fruit, but quite probably future research may remedy this.

Allowing for the admitted toughness and rapidity of spread of this very vigorous plant, I am still of opinion that, under the favourable conditions available in New Zealand, control of blackberry can be obtained through its insect enemies, provided it is understood that such control carries with it a menace to raspberry requiring a single spring spraying with arsenic, and a certain amount of watchfulness in cutting out infected stems each winter when pruning. Even if we admitted *Coroebus rubi*, which I regard as the most promising of all blackberry insects, the menace to roses would be infinitesimal, and would probably be confined to occasional attacks on the water-shoots of Frau Karl Druschki.

Gorse.!

The problem of controlling gorse is a very special one. It is admitted that this plant is of value in supplying nitrogen to the soil, and also in providing, when young, good fodder for sheep. Consequently it appeared to me necessary to find some insect which, while not destroying the plant, would as far as possible prevent it from seeding. The explosive scattering of the seeds from the ripened pods appears to be the only important method of spread of the plant. Consequently an insect which will eat out the pods without previously destroying the blossom is highly desirable.

Such an insect occurs in many areas in England, chiefly on commons. It is *Apion ulicis*, a tiny weevil which feeds on gorse without doing much damage, but whose larva feeds inside the green pod and destroys a very large percentage of the seeds. So successful has this insect been in its attacks during the last three or four years on Harpenden

Common, alongside the Rothamsted Experimental Station, that the botanist there has not been able to obtain supplies of seeds during that period. *Apion ulicis* Forst. is well known throughout Britain, and feeds only on gorse, though there is a record of its having been found on broom once, which needs confirmation. The mode of feeding of both larva and beetle indicated that it would not attack any of the softer leguminous plants. At Harpenden the beetle has been common for many years without ever touching the clover, lucerne, peas, beans, or any other Leguminosae. Dr. Imms has given it as his opinion, and I agree, that any further testing of this insect in England is a mere waste of time, as it is already quite clear that it will not attack any plants of economic value. I think it should be tested out on blue and yellow lupins under New Zealand conditions, but do not anticipate that it will be able to damage either. A provisional permit has been granted for a single consignment of these insects. In my opinion this one insect should suffice for the complete control of gorse in New Zealand. I regard it as one of the most valuable and also one of the safest insects so far discovered in connection with the control of pest weeds.

Tortrix uliciana attacks the flowers of gorse, and might prove of value, but I should not recommend a study of this insect except in the improbable event of *Apion ulicis* proving a failure.

St. John's Wort.

This weed is more especially an Australian problem, but the possibility of its becoming a serious pest in the North Island of New Zealand and elsewhere in the Empire must not be lost sight of. In the Ovens Valley, in Victoria, it has greatly increased in size and vigour, and has put a very large area of land out of cultivation.

The plant presents a special problem owing to the general lack of the knowledge of the insects which feed on it. *Chrysomela varians* and *Chr. hyperici* attack the leaves, both as larvæ and as beetles; neither species is known to feed on anything else. *Anaitis plagiata* (treble-bar moth) and its close ally *A. effumata* are geometrid moths whose caterpillars attack both plants, but are so abundant in places where St. John's wort is rare that it seems highly probable that they do actually feed on other plants also. Several species of *Perrisia* form galls on the plant, especially *P. hyperici* and *P. scrotina*. A number of Tineoid moths attack the leaves and shoots, especially *Depressaria hypericella*, *Cracilaria auroguttata*, *Epinotia hypericana*, and *Aristotelina atrella*.

Thus it will be seen that, provided the introduction of these insects can be made with safety to other plants of economic value, there is a strong probability of the insect enemies gaining complete control. The policy of attempting to control this weed biologically is a sound one, provided that sufficient work is done first in England to ensure the safety of the species later imported into Australia.

Ragwort.

This weed is spreading very greatly over large areas of the Empire, including New Zealand. As it is poisonous to both cattle and horses, and takes possession of large areas of both good and waste land, the problem of its future control is an important one.

There are two insects which attack the weed vigorously and to a large extent successfully in England—viz., *Tyria jacobaeae* Linn. (the cinnabar-moth) and *Homoeosoma cretacella* Rsl. The former has a voracious larva which often eats the plant completely to the ground, and must be considered a most valuable species for control; the latter has a smaller larva which mines in the stems and damages the flower-heads. The combination of these two species should ensure adequate control. The main difficulty would appear to be the acclimatizing of these moths in New Zealand. This may prove unexpectedly difficult, especially as the pupa of *Tyria jacobaeae* seems to be subject to a severe fungoid disease. *Tyria jacobaeae* feeds also on groundsel, and has once been recorded on coltsfoot (this needs confirmation); both these plants are weeds. *Homoeosoma cretacella* is only known on ragwort.

A provisional permit has been issued for both insects, and large supplies of *Tyria jacobaeae* have already been sent to New Zealand. Late frosts destroyed *Homoeosoma* in England in 1926, but supplies should be available in 1927.

Tests will be very carefully carried out with these moths to find out whether they will damage any of the native species of *Senecio* or allied genera.

Foxglove.

This is a very poisonous plant, which is likely to become a bad pest in hilly country in various parts of the Empire, including portions of New Zealand. Scarcely any insects are known to feed upon it. A small moth, *Eupithoeccia pulchellata* Steph., attacks the flowers; the larva later bores into the seed-capsule and prevents seeding to a large extent. The heath fritillary, *Melitaea athalia*, is generally reared by breeders on foxglove, but its normal host plant appears to be the parasitic *Melampyrum*, another pest fortunately absent so far from New Zealand.

Provisional permits have been issued for both these insects, and a supply of hibernating larvæ of *Melitaea athalia* has been shipped in cool storage to New Zealand. The attempt to rear a race of this insect which shall normally feed on foxglove is of the greatest scientific interest. Normally a female moth or butterfly will only lay its eggs on the food plant on which its larva originally fed. Thus the problem is to rear a brood artificially on foxglove in captivity, and then select those females which show the greatest tendency to return to this plant for egg-laying. As *Melampyrum* is absent from New Zealand, non-success of this attempt will only mean that the insect will die out.

Convolvulus.

It appears to be the general opinion of botanists in England and New Zealand that this plant (*Calystegia Sepium*) will become a very serious menace in the near future. While at present there seems to be no prospect of control by means of insect enemies, the subject is by no means exhausted, and every effort will continue to be made to find a species which will prevent it from seeding or will destroy it in some other manner.

HEDGES AND SHELTER-TREES FOR HOMESTEAD AND FARM.

W. C. HYDE, Horticulturist, Horticulture Division

As agricultural practice is so largely built up on the traditions of the past it was natural for the early settlers of this country to surround their paddocks with a ditch, the spoil from which was neatly built into a sod wall alongside, and along the top of which a hedge was planted or sown. For that was the common custom in their Mother-land; there a copious rainfall on heavy land demanded ample drainage, and whitethorn hedges carefully grown and plashed held the stock secure. On the small farms there, with their small fields and cheap labour, the method had long been successfully demonstrated, and it had become an established custom.

On the larger farms of this country, with its large paddocks and extended fence-lines and higher cost of labour, the trimmed hedge, plashed and stock-proof, has not kept pace with the extension of settlement. It has been replaced by the more immediate and effective fence of strained wire. This excellent fence, however, leaves the seed-bed of the field in crop exposed to prevailing winds, which frequently do serious damage, especially where the soil is light and friable; also to mature crops. Stock, too, are exposed to stormy weather in winter and spring, when considerable loss is frequently incurred from this cause, as also after shearing. In hot weather, also, the welfare of the stock demands suitable shade during the heat of the day, and crops derive benefit from an atmosphere that is tempered by the proximity of hedge and shelter trees.

SHELTER PLANTATIONS.

To meet this demand of farm economy shelter-belts are required to break the force of the main prevailing winds, with hedges of a desirable habit planted at suitable angles. The hedges, however, should be reduced to a minimum extent to avoid the labour which even the most suitable plants sometimes require, and the remaining intersecting fences may be of wire only. The best examples of this method of dealing with the problem have given such results as have led to considerable inquiry on the subject.

Shelter-belts on the farm are often unsatisfactory owing to quite inadequate planting. A row or two of *Cupressus macrocarpa* or *Pinus insignis* is planted to which stock is soon admitted, with a result that the trunks and lower branches become bare; and while affording a little useful shade in hot weather they are worse than useless as shelter in stormy weather, owing to the bleak draught created by the winds passing beneath the boughs. In other cases such trees as those above mentioned are planted on heavy land and grow into large, coarse timber that quite overgrows the situation and purpose for which they were planted.

The cost, importance, and permanence of shelter plantations is sufficiently great to warrant a long and careful study of the local conditions before plants are decided on, the latitude, altitude, climate,

and soil being carefully considered. In open country and broad valleys the matter is sometimes best dealt with under some system of co-operation between adjoining settlers. In any case a thorough study should be made of mature trees growing on the class of land and under the climatic conditions to be dealt with. A half-grown plantation that has been well managed generally looks attractive, but the question often still remains as to how it is going to mature.

Present-day planters have a valuable heritage in the experience of early settlers who have done important experimental work and demonstrated many successes and failures. An excellent summary of this work may be obtained free on application to the State Forest Service, together with methods of planting. It remains but to properly proportion the shelter plantations to the areas to be dealt with; while about the homestead some effect and economy may be considered by

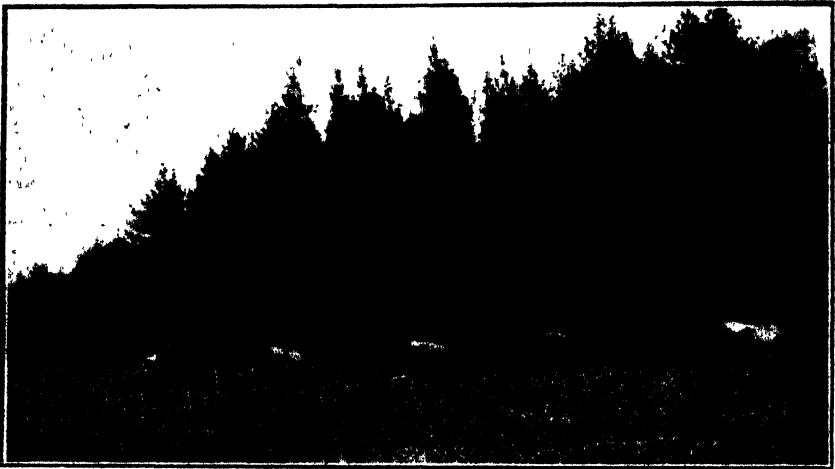


FIG. 1. SHELTER-BELT OF THORNY ACACIA AND JACK PINE AT RUAKURA STATE FARM.

giving a little more variety to the planting and harmonizing it with the usual orchard of fruit-trees and nuts. Where a shade tree or group of trees are planted in a paddock it is as well to consider the advisability of planting chestnuts, stone-pines, or walnuts, which, besides affording the necessary shade, also give a useful return in nuts. The two former do well usually on hilly country, and the latter on alluvial ground.

Whatever plantations are made it is essential that they should be permanently fenced off from stock, which, if admitted, will very soon destroy the bottom growth and render the plantation worse than useless for shelter purposes.

SHELTER TREES AND HEDGES.

Transverse shelter-hedges planted at suitable intervals—they need not be down every fence-line—will afford valuable supplementary shelter in most districts. Indeed, in the more sheltered localities and on the smaller sections the single-line shelter-hedge may provide all that is required in this way.

Lawson's cypress (*Cupressus Lawsoniana*) has grown into high favour as a permanent evergreen shelter-hedge on medium to good land with a fair rainfall. Planted about 3 ft. apart it matures into a dense shelter about 10 ft. to 12 ft. high, naturally thickly clothed at the base, and tapering to the top in a way that demands no attention in the way of trimming after it is once established. It is sometimes seen with a ditch on the one side and a wire fence on the other in excellent condition and entirely satisfactory. Its immunity from troublesome diseases is a feature.

Lombardy poplar (*Populus fastigata*) deserves its popularity on flat country inclined to be wet. Planted rather close it makes a narrow



FIG. 2. MIXED PLANTATION—OREGON PINE, LAWSON'S CYPRESS, BIRCH, AND POPLAR—AT RUAKURA.

effective breakwind with a minimum of attention. An occasional shortening of the tops is about all that is necessary. Its deciduous character is in some instances an advantage. The value of this shelter-tree is generally improved if it is interplanted with a suitable evergreen shrub to ensure a close bottom growth.

Barberry (*Berberis vulgaris*) is an evergreen shrub that is very popular among farmers as a stock-proof shelter-hedge. As it is commonly grown from seed it is not surprising to find the great number of different types that now exist. Many of these are of very poor habit, some being almost deciduous and others carrying heavy crops of seed, which are carried by birds into hilly country, where they grow and add to the noxious-weed problem. On this account barberry is now included in the Third Schedule of the Noxious Weeds Act—that is, the local body can declare the plant a noxious weed. In

Taranaki barberry is now allowed only where it is regularly clipped to restrict fruit-bearing, and it is liable to be similarly declared in other districts.

One of the most desirable varieties of this excellent hedge-plant is grown extensively in the Thames and Waikato districts. It has been fully described by Mr. W. H. Taylor in an article in the *Journal* for March, 1922. It very rarely ripens fruit, and when planted 12 in. to 15 in. apart in a single line it forms a very dense hedge 10 ft. to 12 ft. high. This habit necessitates propagation by means of cuttings. These should be made about 7 in. to 8 in. long, in winter, and planted in nursery rows to root—which they do very readily—before they are planted out in the fields during the following planting season. The cuttings must be planted firmly with only two buds above the surface and the land kept free from weeds.

The hawthorn (*Crataegus oxycantha*), which was held in such high esteem by early settlers and planted extensively, has fallen into disfavour. In the mild climate of New Zealand it is subject to a great



FIG. 3. GROUP OF EUCALYPTUS MACARTHURI AT END OF SHELTER-BELT OF POPLAR UNDERPLANTED WITH LAWSON'S CYPRESS AT RUAKURA.

number of diseases, most of which also affect orchards and gardens. With this serious disability it is an undesirable hedge-plant compared with others that are available.

Osage orange (*Maclura aurantiaca*), the bow-wood of America, where it is the popular hedge-plant in the middle States, is a small tree of something the same habit as hawthorn. It is a thorny deciduous tree with rather large pear-tree-like foliage, the pistillate (female) plants of which bear large orange-like fruits that give the tree its name. It is easily raised from seed, and planted close—about 6 in. apart—it makes a dense stock-proof hedge of a similar class to hawthorn. It is free from serious pests, and has proved to be hardy under some rather severe tests made in this country. An important precaution in raising this hedge is to prune the tops back each winter for the first two or three years in order to induce strong lateral branches about the base of the hedge.

Boxthorn (*Lycium horridum*): This thorny evergreen from South Africa forms a hedge that is securely cattle-proof. It has been proved to effectively withstand the heavy salt-laden winds that prevail in

some coastal districts and are so destructive to trees in general. On well-drained soils this hedge is very thrifty. The large strong thorns with which it is armed, while effective in holding stock, set a heavy task for one who has to cut back a neglected hedge. Wounds from these thorns are often serious where they are neglected.

Gorse (*Ilex europæus*) was extensively sown by the early settlers as a hedge-plant on dry, light land, and in exposed situations it quickly formed valuable shelter, and fodder, too, that was of great value in dry seasons. As a hedge, however, it is insecure, owing to numerous gaps that soon develop. Its tendency to become a serious weed pest is also a menace.

In addition to Lawson's cypress reference should be made to macrocarpa (*Cupressus macrocarpa*), also *Cupressus torulosa*. On a good alluvial land where macrocarpa is sometimes planted it develops into a very large rough shelter, covering a great deal of land, but bare



FIG. 4. SHELTER-HEDGE OF LAWSON'S CYPRESS AT RUAKURA.

about the base, where shelter is most needed. Under such conditions it is generally unsuitable. On soils of fair quality *Cupressus torulosa* is a better tree for the purpose; it is of more moderate height, and the side branches are shorter and more compact. Without any trimming it makes an excellent shelter-hedge. On lighter land the macrocarpa cypress often does well, and planted in an untrimmed row about 3 ft. apart along a fence-line it is often found satisfactory. But with all of these cypresses that form such excellent shelter under right conditions it is necessary that they be fenced off from the traffic of stock, which otherwise very soon destroy the lower branches.

GARDEN HEDGES.

For planting about the homestead there is often a demand for a hedge-plant that, while it is not required to be stock-proof, is needed for a shelter or screen. For this purpose it would be hard to find anything better than our own native evergreen shrubs.

Taupata (*Coprosma Baueri*) is justly popular for the purpose. If the young plants are cut back for the first two or three years to cause

them to make strong side growth near the ground, this plant quickly forms an evergreen hedge of shining leaves that will stand the strongest sea-winds.

Silver akeake, of the Chatham Islands (*Olearia Traversii*), is also suitable for a hedge in exposed situations. It is a dark evergreen with a silver reverse to the leaves.

Tarata (*Pittosporum eugenoides*) is an evergreen of a brighter shade with fragrant flowers, and is as good as the silver akeake for a hedge exposed to cold salt winds.

Karo (*Pittosporum crassifolium*) makes a good evergreen hedge by the coast, but it is not quite so hardy as the preceding species.

Kohuhu (*Pittosporum tenuifolium*) is very hardy, and makes an excellent hedge in almost any situation.

Golden akeake (*Olearia Forsteri*) has been largely planted, its golden-green foliage with frilled margins being very familiar. Unfortunately, it is often seriously damaged by a native gall insect or attacked by scale insects and black fungus, and so is undesirable for hedge purposes.

Elæagnus japonica is a vigorous evergreen shrub with russet-green foliage. It has been largely used for underplanting pines and large tree shelter. Its vigorous spreading habit demands frequent trimming, and in the warmer districts it is subject to thrips and many insects that are troublesome in gardens.

Escallonias of various sorts are often planted for hedges in gardens, and, with a satisfactory rainfall, they are very suitable. They are natives of South America.

Common laurel (*Cerasus laurocerasus*) is a well-known evergreen from Asia Minor which makes a clean, handsome hedge when well kept. It does well even in shady situations.

Chinese privet (*Ligustrum sinensis*) is a hedge-plant that has long been popular. It also is valuable for underplanting forest-trees, in the shade of which it flourishes.

GENERAL.

The planting of hedges often fails owing to the lack of suitable preparation of the land and protection of the plants from stock. The land to be planted should be thoroughly cleaned of all weeds and growth, especially twitch. Unless this is done before planting it is almost impossible to maintain the necessary cultivation required for the first two or three years until the plants are thoroughly established. Neither will the plants while young and tender stand the treading and browsing of stock. A well-established shelter-hedge is an attractive and valuable asset to the garden or farm, and is well worth the trouble of the requisite preparation and care.

Hedges frequently suffer from neglect and unseasonable trimming; they are thereby often stunted and bare. Where they have been neglected, and it is necessary to cut back into the old wood, the operation should be performed at the beginning of spring in the case of evergreens, and rather earlier in the case of deciduous plants.

EXPERIMENTS ON MANURING OF POTATOES IN CANTERBURY, SEASON 1925-26.

A. W. HUDSON, B.Agr., B.Sc., Instructor in Agriculture, Christchurch.

THE results of two experiments on the manuring of potatoes in Canterbury in the 1924-25 season were published in the *Journal* for April and May, 1926, under the names of F. E. Ward and the present writer. The experiments were continued with certain modifications on the same farms of Mr. L. C. Banks, Coutts Island, and Messrs. W. and A. Campion, Prebbleton, in the 1925-26 season. The method of conducting the work was described in the *Journal* for July, 1926, page 12.

Two experiments were carried out on each farm. Those on Mr. Banks's farm are here designated 1A and 1B, and those on Messrs. Campion's farm 2A and 2B. In each case the two experiments were contiguous.

In the 1924-25 season a mixture of superphosphate and bonedust, at 3 cwt. per acre, was compared with super, 3 cwt. per acre, on Mr. Banks's farm, and a mixture of super and Ephos phosphate, at 3 cwt. per acre, was compared with super, 3 cwt. per acre, on Messrs. Campion's property. In both experiments the straight super proved superior to the mixtures. These results, while conclusive enough for the farms and seasons in question, are not regarded as sufficient evidence for making a general statement on the relative merits of straight-out soluble phosphate as compared with a mixture of soluble and insoluble phosphates. It is noteworthy, however, that Sir E. J. Russell has said that super is the best form of phosphate for potatoes. It was considered that too many factors had been included in the trials of 1924-25, and a decision was made for the following season to use super alone as the phosphatic fertilizer, and at a later date again try the soluble phosphate against a mixture of soluble and insoluble.

Experiments 1a (Banks) and 2a (Campion).

Details of treatments and results for 1925-26 are as follows:—

	Quantity per Acre.
(1.) Superphosphate, 42 '44 grade	3 cwt.
(2.) Superphosphate, 42 '44 grade	5 cwt.
(3.) Superphosphate, 42 '44 grade	7 cwt.
(4.) Control (no manure).	

Six replications of each of the manured plots and three of the controls were sown. The object of the experiment was to determine as near as possible the most payable quantity of super that could be applied.

EXPERIMENT 1A.

Variety: Dakota. Date sown: 25th and 26th November, 1925. Date dug and weighed: 2nd and 4th June, 1926. History of paddock: 1922-23, wheat; 1923-24, clover, which became badly infested with twitch.

Observations during growth: On 13th January, 1926, the growth of tops on the control areas was very poor as compared with

that of the phosphated plots (see Fig. 1). The plots receiving 5 cwt. and 7 cwt. super showed a slightly better growth than those receiving 3 cwt.



FIG. 1. PORTION OF EXPERIMENTAL PLOTS ON MR. BANKS'S FARM.

Photo taken early in February. The three rows on right are those of a control (no manure) plot. To left of these are manured plots, the first three being super at 7 cwt. per acre.

[Photo by F. E. Ward.]

Results are shown in the following table :-

Table 1.—Experiment 1A.
Area of individual weighed plot, $\frac{1}{16}$ acre.

Grade.		Number of Paired Plots.	Yield in Tons per Acre.		Difference in Favour of		Difference significant (S.) or non-significant (N.S.).*
			Control.	Super, 3 cwt.	Control.	Super, 3 cwt.	
Total	..	9	5.72	8.48	..	2.76	S.
Table	..	..	4.54	7.00	..	2.46	S.
Seed	..	..	1.69	1.36	..	0.27	S.
Small	..	..	0.10	0.13	..	..
			Super, 3 cwt.	Super, 5 cwt.	Super, 3 cwt.	Super, 5 cwt.	
Total	..	18	8.71	9.24	..	0.53	S.
Table	..	..	7.14	7.89	..	0.75	S.
Seed	..	..	1.44	1.28	0.16	..	S.
Small	..	..	0.13	0.07	..	..
			Super, 5 cwt.	Super, 7 cwt.	Super, 5 cwt.	Super, 7 cwt.	
Total	..	18	9.24	9.32	..	0.08	N.S.
Table	..	..	7.89	7.81	0.08	..	N.S.
Seed	..	..	1.28	1.40	..	0.12	N.S.
Small	..	..	0.07	0.11	..	..

NOTE.—Yields of "small" grade not examined statistically.

* A difference is regarded as "significant" when the chances are 30 to 1 or more in its favour.

Comments on Table 1.

Evaluation of increases are based on table potatoes at £3 per ton and seed at £1 10s. per ton (see *Journal*, April, 1926, page 259). The cost of super is the price then current at country stations—£7 per ton.

(a.) The amount of 3 cwt. of super per acre shows an extremely profitable increase of practically $2\frac{1}{2}$ tons of table potatoes and $\frac{1}{4}$ ton of seed, to the value of £7 17s. 6d. The cost of manure per acre being £1 1s., the profit resulting from its use is about £6 16s. 6d. per acre. The super has caused a definite increase in the percentage of table, and decrease in the seed kind. The difference between percentages of small was not significant.

(b.) The addition of another 2 cwt. to the extremely profitable 3 cwt. application shows a still greater increase in yield of just over $\frac{1}{2}$ ton per acre. The table potatoes on the 5 cwt. plots show an increase of $\frac{3}{4}$ ton (greater than the total difference on account of the increased percentage of table), and a decrease in the yield and percentage of seed and small. The value of $\frac{3}{4}$ ton table potatoes equals £2 5s., and this, less value of $\frac{1}{4}$ ton seed (5s.), equals £2. Hence the increased profit over that resulting from the use of 3 cwt. super is £1 6s. (£2, less cost of 2 cwt. super).

(c.) 7 cwt. of super shows no significant difference from 5 cwt. Hence 3 cwt. has proved highly profitable on this farm, as it did in the previous season; 5 cwt. has given even better results, but 7 cwt. shows no superiority over 5 cwt.

EXPERIMENT 2A.

Variety: Dakota. Date sown: 12th November, 1925. Date dug and weighed: 30th April, 1926. History of paddock: January–April, 1925, rape; winter and early summer, 1924, fallow; 1923–24, wheat.

Observations during growth: 12 1 26—All the controls were backward in growth, and the plots receiving 7 cwt. super were slightly better than the remainder. 2/2, 26—At this date the controls were in flower, as seen in Fig. 2 (next page). On the manured plots the flowers had almost disappeared. 17/3 26—The tops on the manured plots were commencing to die off, the controls still being green.

Results are shown in Table 2 (next page).

Comments on Table 2.

(a.) 3 cwt. super has increased the total yield by approximately $\frac{1}{2}$ ton per acre. There is no increase in the table kind, the increase being represented by small and seed. The increased seed has a value of about 10s. 9d., and as the cost of super per acre was £1 1s. the application has not been profitable. The percentage of table potatoes is greater on the controls by about $4\frac{1}{2}$ per cent., with a corresponding decrease in the smaller kinds. This result is contrary to those already recorded, and as an explanation it is suggested that the longer growing-period of the control plots enabled them to benefit from the late rains. The early part of the growing season was decidedly dry, while good rains fell in February.

(b.) The 5 cwt. quantity of super compared with the 3 cwt. shows an increase in total yield and yield of table potatoes, with a decrease

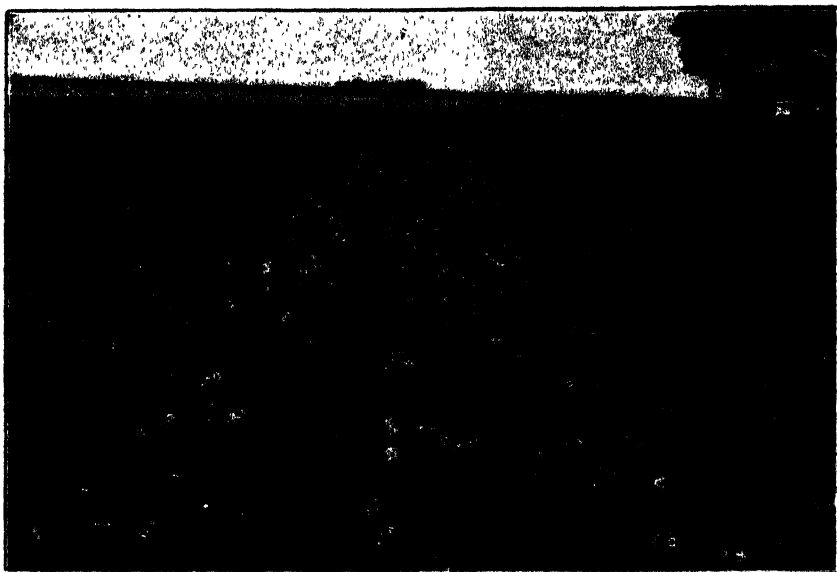


FIG. 2. PORTION OF EXPERIMENTAL PLOTS ON MESSRS. CAMPION'S FARM.

Photo taken early in February. Centre—three rows of control (no manure) plots; right—three rows super at 7 cwt. per acre; left—three rows super at 3 cwt. per acre.

[Photo by F. E. Ward.]

Table 2.—Experiment 2A.

Area of individual weighed plot, $\frac{1}{257}$ ac. c.

Grade.		Number of Paired Plots.	Yield in Tons per Acre.		Difference in Favour of		Difference significant (S.) or non-significant (N.S.).
			Control.	Super, 3 cwt.	Control.	Super, 3 cwt.	
Total	..	17	9.42	9.95	..	0.53	S.
Table	..	..	7.55	7.53	..	..
Seed	..	..	1.48	1.84	..	0.36	S.
Small	..	..	0.39	0.57	..	..
			Super, 3 cwt.	Super, 5 cwt.	Super, 3 cwt.	Super, 5 cwt.	
Total	..	25	9.57	9.92	..	0.35	S.
Table	..	..	7.23	7.73	..	0.50	S.
Seed	..	..	1.80	1.67	0.13	..	S.
Small	..	..	0.54	0.52	..	..
			Super, 5 cwt.	Super, 7 cwt.	Super, 5 cwt.	Super, 7 cwt.	
Total	..	25	9.92	10.26	..	0.34	N.S.
Table	..	..	7.73	7.81	..	0.08	N.S.
Seed	..	..	1.67	1.87	..	0.20	S.
Small	..	..	0.52	0.58	..	..

in the yield of seed. The increased quantity of phosphate has somewhat retrieved the position so far as the percentages of various grades are concerned, and shows an increase in the percentage of the table kind. The value of the increase in table is £1 10s., and the value of the seed will be the value of the increase of the 3 cwt. super plots over control (10s. 9d.) less the value of 0.13 ton. This is approximately 6s. 9d. The total increase is therefore worth £1 16s. 9d., and since the 3 cwt. of super shows no benefit so far as table potatoes are concerned the whole of the cost of 5 cwt. must be charged against the increased return. The super cost £1 15s., and the resulting profit is only 1s. 9d., certainly not sufficient to justify the use of the phosphate in this case.

(c.) The 7 cwt. quantity shows no significant difference from the 5 cwt., except that there is a slight increase in the seed-potato yield. Hence the use of the former quantity has resulted in a loss.

Experiments 1b (Banks) and 2b (Campion).

The manurial treatments for 1B were as follows :—

	Quantity per Acre.
(1.) Super, 42 '44 grade	3 cwt.
(2) Super, 3 cwt., plus sulphate of potash at 1 cwt per acre	4 cwt.
(3.) Super, 3 cwt., plus sulphate of potash at 1 cwt per acre (potash top-dressed)	4 cwt.
(4.) Super, 3 cwt., plus sulphate of ammonia at 1 cwt per acre	4 cwt.
(5) No. 4 mixture, plus sulphate of potash at 1 cwt per acre (potash top dressed)	5 cwt.

For experiment 2B the treatments were as for 1B, except that 1 cwt. of dried blood was used instead of the sulphate of ammonia. Where the potash was top-dressed this was done a fortnight after sowing of the plots, the application being made with a Planet Jr. implement. The object of applying the potash as a top-dressing after sowing was to endeavour to find out if the method of application of potash was of consequence. The results of the previous year on Mr. Banks's farm showed that when the manures were top-dressed the potash had a marked effect in increasing the yield and percentage of table potatoes (see *Journal* for April, 1926, p. 263).

EXPERIMENT 1B.

Planting was done at the same time as that in Experiment 1A. Observations made during the growing-period showed that the plots receiving sulphate of ammonia were conspicuous by their greater growth and deeper-green colour. The other plots were similar to one another in appearance. Results are given in Table 3 (next page).

Comments on Table 3.

(a.) Super *versus* super plus sulphate of potash : The yields of these treatments do not differ to a statistically significant degree, although the increase in total yield of $\frac{1}{2}$ ton, with chances of 22 to 1 in its favour, is approaching accepted certainty. Owing to mixing of plots a portion of this experiment had to be discarded, and the remaining portion was sufficient to give only sixteen weighings in each treatment.

Table 3.—Experiment 1B.
Area of individual weighed plot, $\frac{1}{16}$ acre.

Grade.		Number of Paired Plots.	Yield in Tons per Acre.		Difference in Favour of		Difference significant (S.) or non-significant (N-S.).
			Super, 3 cwt.	Super and Potash.	Super.	Super and Potash.	
Total	..	16	9.06	9.56	..	0.50	N-S.
Table	..	..	7.75	8.14	..	0.39	N-S.
Seed	..	..	1.17	1.25	..	0.08	N-S.
Small	..	..	0.14	0.17	..	..
			Super and Potash.	Super and Potash (T.D.).	Super and Potash.	Super and Potash (T.D.).	
Total	..	16	9.50	9.09	0.47	..	S
Table	..	..	8.14	7.81	0.33	..	N-S
Seed	..	..	1.25	1.12	0.13	..	N-S.
Small	..	..	0.17	0.16	..	..
			Super.	Super and S.A.	Super.	Super and S.A.	
Total	..	15	9.07	11.20	..	2.13	S.
Table	..	..	7.78	9.57	..	1.79	S.
Seed	..	..	1.15	1.45	..	0.30	S.
Small	..	..	0.14	0.19	..	..
			Super and S.A.	Super, S.A., and Potash.	Super and S.A.	Super, S.A., and Potash.	
Total	..	15	11.20	10.98	0.22	..	N-S
Table	..	..	9.57	9.37	0.20	..	N-S.
Seed	..	..	1.45	1.39	0.06	..	N-S
Small	..	..	0.19	0.21	..	..

NOTE.—T.D. signifies potash top-dressed; S.A., sulphate of ammonia.

(b.) Super plus potash *versus* super plus potash (potash top-dressed): The application of the whole mixture with the seed has had in this case an advantage to the extent of approximately $\frac{1}{2}$ ton (total) yield per acre. The potash-top-dressed plots show practically no superiority over super at 3 cwt.

(c.) Super *versus* super plus sulphate of ammonia: The increase of 1.79 tons of table and 0.3 ton of seed due to the sulphate of ammonia is highly profitable. The cost of sulphate of ammonia is £1 2s. per cwt., and the value of the increase approximately £5 17s. The net profit is therefore £4 15s. In Table 1 it has been shown that the profit from 3 cwt. of super is £6 16s. 6d., and the total profit resulting from the use of super and sulphate of ammonia is therefore about £11 11s. 6d. per acre.

(d.) Super plus sulphate of ammonia *versus* super plus sulphate of ammonia plus sulphate of potash (potash top-dressed): The addition of potash has had no beneficial effect, the complete mixture yielding approximately the same as super plus sulphate of ammonia.

(e.) Neither sulphate of ammonia nor potash has affected the percentages of the various grades.

EXPERIMENT 2B.

This was sown at the same time as Experiment 2A. At no time during growth was there any appreciable difference in the appearance

of the plots, although those receiving blood appeared to have a slightly greater growth of top and a little deeper colour. Results are given in Table 4.

Table 4.—Experiment 2B.

Area of individual weighed plot, 207 acre.

Grade.		Number of Paired Plots.	Yield in Tons per Acre.		Difference in Favour of		Difference significant (S.) or non-significant (N-S.)
			Super.	Super and Potash.	Super.	Super and Potash.	
Total	..	25	10.48	10.87	..	0.39	S.
Table	..	..	8.12	8.35	..	0.23	N-S.
Seed	..	..	1.88	1.97	..	0.09	N-S.
Small	..	..	0.48	0.55	..	..
			Super and Potash.	Super and Potash (I.D.)	Super and Potash.	Super and Potash (I.D.)	
Total	..	30	10.83	10.71	0.12	..	N-S.
Table	..	..	8.34	8.52	..	0.18	N-S.
Seed	..	..	1.95	1.73	0.22	..	S.
Small	..	..	0.54	0.46	..	..
			Super.	Super and Blood.	Super	Super and Blood	
Total	..	25	10.48	10.20	0.28	..	S.
Table	..	..	8.12	7.40	0.72	..	S.
Seed	..	..	1.88	2.13	..	0.25	S.
Small	..	..	0.48	0.66	..	..
			Super and Blood.	Super, Blood, and Potash (I.D.)	Super and Blood.	Super, Blood, and Potash (I.D.)	
Total	..	30	10.23	11.13	..	0.90	S.
Table	..	..	7.43	8.53	..	1.10	S.
Seed	..	..	2.14	2.00	0.14	..	S.
Small	..	..	0.66	0.60	..	..
			Super.	Super and Potash (I.D.)	Super	Super and Potash (I.D.)	
Total	..	25	10.48	10.81	..	0.33	N-S.
Table	..	..	8.12	8.61	..	0.49	S.
Seed	..	..	1.88	1.74	0.14	..	S.
Small	..	..	0.48	0.46	0.02	..	
			Super	Super, Blood, and Potash (I.D.)	Super	Super, Blood, and Potash (I.D.)	
Total	..	25	10.48	11.04	..	0.56	S.
Table	..	..	8.12	8.43	..	0.31	N-S.
Seed	..	..	1.88	2.01	..	0.13	N-S.
Small	..	..	0.48	0.61	..	0.13	

NOTE.—I.D. signifies potash top-dressed.

Comments on Table 4.

(a.) *Super versus super plus potash*: The increase in total yield of 0.39 ton due to the potash is significant. It follows, therefore, that the increases in the various grades are real ones, although the chances in favour of significance are low. The value of 0.23 ton of table and 0.09 ton of seed kinds is approximately 17s., and since the potash cost 18s. per cwt. there is no margin of profit. The percentages of the various grades are not appreciably affected.

(b.) Super plus potash *versus* super plus potash (potash top-dressed) : The top-dressing of the potash has caused diminution in the yield of seed potatoes. The increase of 0.18 ton of table is not statistically significant. However, the percentage of table is slightly increased, with a corresponding decrease of the smaller kinds due to top-dressing of the potash.

(c.) Super *versus* super plus blood : A diminution in total yield and yield of tables and an increase in the yield of seed has been caused by the blood. The percentages of the various grades are similarly affected.

(d.) Super and blood *versus* super plus blood plus potash (potash top-dressed) : The potash has been instrumental in counteracting the bad effect of the blood, and the increase of 1.1 tons of table would be quite profitable under ordinary circumstances.

(e.) Super *versus* super plus potash (potash top-dressed) : A direct comparison of these treatments shows a slightly profitable benefit from the potash. The increase of approximately $\frac{1}{2}$ ton of table is worth about £1 10s., and this, less the value of 0.14 ton reduction in seed, equals approximately £1 6s. Hence the profit from potash (leaving out of account the phosphate, which in Experiment 2A was shown to be unprofitable at 3 cwt. per acre) is about £1 6s. — 18s. = 8s., and hardly sufficient to justify its use.

(f.) Super *versus* super plus blood plus sulphate of potash (potash top-dressed) : Here the direct comparison of these treatments shows a significant total increase, and the table and seed increases are therefore regarded as real ones. Their value is about £1 2s. 6d. The blood, which, it has been shown, had the effect of diminishing the yield, has therefore placed a severe handicap on the potash.

The keen co-operation maintained by Messrs. Banks and Campion is much appreciated, and the Department's thanks to them is here accorded.

NEW ZEALAND AGRICULTURAL COLLEGE COUNCIL.

THE following appointments have been made, forming the first Council of the newly constituted New Zealand Agricultural College : Messrs A. Morton, H. B. Stuckey, N. Francis, and R. A. Rodger (by the Governor-General) as Government representatives ; Hon. G. Fowlds and Mr. T. U. Wells (by Auckland University College) ; Professor T. A. Hunter and Mr. P. Levi (by Victoria University College) ; Sir James G. Wilson (by the Board of Agriculture). The Council held its first meeting on 1st February current, and elected Hon. G. Fowlds as Chairman.

Empire Fruit in Britain.—The Temperate-fruits Sub-Committee of the Empire Marketing Board is planning an investigation into the question of Empire-grown fruit arriving in Britain damaged or unfit for sale. The committee's inquiries have already shown that the problem is one of concentrating, with scientific help, upon improvements in production, grading, packing, and marketing, rather than of merely measuring damage actually sustained. Plans are being worked out, in conjunction with the Cambridge Low Temperature Research Station, for the inspection of apple shipments on their arrival, and for the linking-up of observations made on the arrival of cargoes with observations made in the orchard and at the time of shipment.

TOP-DRESSING OF HILL-COUNTRY GRASSLAND.

TWO NEW HAND DISTRIBUTORS.

W. J. McCULLOCH, Instructor in Agriculture, Palmerston North.

THE great forward movement in the stimulation of our low-country grasslands where horse-drawn manure-distributors can be utilized has proved beyond doubt that the top-dressing of pastures is an economically sound practice. Although there are still large areas of this type of country awaiting the mechanical distributor, there is also a very extensive acreage of good hill country not accessible to the usual wheeled type of machine, but which can be profitably top-dressed.

The remarkable results achieved from manuring low-country grassland, coupled with the fact that much of the better-class hill country has deteriorated as the result of the steady drain of fertility in the shape of wool and mutton, has excited the keen interest of hill-country farmers—so much so that a general movement is perceptible in the direction of improving the lowered carrying-capacity by top-dressing. Only a few years ago the suggestion to top-dress steep hill country would have been ridiculed as impracticable and economically unsound; and although the practice is not yet general, it has nevertheless become an accomplished fact and is growing steadily. A significant feature is that the experience of top-dressing a small area of hill country practically always leads to the treatment of a larger area the following year.

Up to the present the only practicable method of top-dressing steep hill country has been to scatter the manure actually by hand from a sowing-sheet, sack, or benzine-tin with the side cut out, but all such devices necessitate carrying the container in front of the operator, attached by straps over the shoulder in such a manner that the manure is easily accessible to the hand. This greatly hampers freedom of movement in walking, and each time a handful of material is grasped a certain amount of spillage is likely to occur, which does not make for even distribution. The operator walks with a continuous cloud of dust about the upper portions of the body, a considerable quantity of which is unavoidably inhaled; the hands often become sore—and altogether it is disagreeable work and difficult to get men to undertake. A reasonable average acreage by this system works out at about 6 acres per man per day.

Recently a competition organized by Messrs. Wright, Stephenson, and Co., Ltd., who offered prizes for the best method of top-dressing hill country where a horse-drawn machine could not be used, resulted, it is understood, in a large number of methods and devices being submitted. Two of these the writer has been enabled to examine and see demonstrated—namely, the “Hildres Hand Manure Distributor,” designed and patented by Mr. L. W. Knight, Opaki Road, Masterton (winner of the first prize), and “Howell’s Manure Distributor,” designed by Mr. L. I. Howell, Paraparaumu (winner of the second prize). Both methods are somewhat similar in principle—although the actual design differs—the manipulation being much alike in each case.



FIG. 1. THE HILDRES MANURE DISTRIBUTOR IN OPERATION ON HILLSIDE.



FIG. 2. FILLING THE HILDRES MACHINE.

The "Hildres" consists of a hopper-shaped galvanized metal container, which is conveniently strapped on the back high up between the shoulders in such a position that a reasonable load of from 40 lb. to 50 lb. of manure can be carried without hampering free movement on rough country. At the lower end of this receptacle is attached a flexible spiral metal tube similar in make to the tubes of an ordinary grain-drill. This tube terminates in a mouth-piece designed with the idea of causing a spray and more even distribution. Within the tube a small agitator is automatically worked as the tube is swung from side to side by hand. The manure gravitates from the container into the upper end of the tube, and the continuous outward throw of the opposite end, which is held low at arm's length, causes the manure to flow out in an even shower.

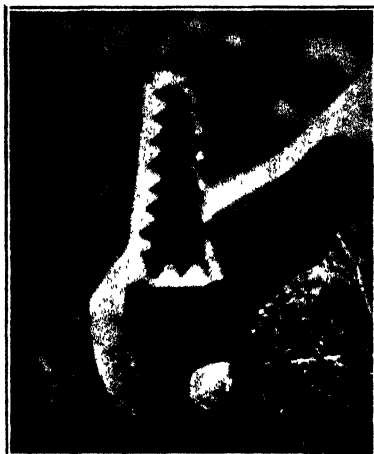


FIG. 3. MOUTHPIECE OF HILDRES DISTRIBUTOR

After witnessing a demonstration on hill-country pasture the writer was given an opportunity to measure the width of cast possible on a ploughed field, and found an even distribution up to 18 ft. wide, although some of the manure could be observed up to 24 ft. in width. Two slides are so arranged at the entrance to the tube that the flow of manure can be controlled, and, together with regulation of pace of the operator, the rate per acre can be fairly well gauged. Careful timing showed that 12 acres per day could be covered by one machine, if the width of the cast was 12 ft., at 2 cwt. per acre.

It is also claimed that grain or grass-seed can be very successfully sown with this distributor in the same manner; likewise the manuring of potatoes before the sets are covered in the rows. The apparatus is substantially built, and, apart from its use on hill country, should prove valuable on small farms where the outlay on a more expensive machine is not justified.

Howell's Manure Distributor is of very simple construction, being a specially shaped canvas bag, at the lower narrow end of which about 2 ft. 6 in. of rubber hose is attached; about 3 in. of the butt of the hose is inside the bag and acts as an agitator. This tube is swung from side to side as in the case of the "Hildres," but no mouthpiece is attached to the end of the rubber hose. The top end of the bag is continued as a broad strap over one shoulder, and is easily adjusted by a spring hook. No slides are used to regulate the flow of manure, this being obtained by using various-sized rubber hose, the latter being easily and quickly detached at will. To replenish with manure, the container bag is unstrapped and laid on the ground, the mouth of the manure-sack inserted, and the required quantity tipped in—the whole operation being speedy and simple. This distributor can also be used for applying manure along drills, &c.

HOWELL'S MANURE DISTRIBUTOR.

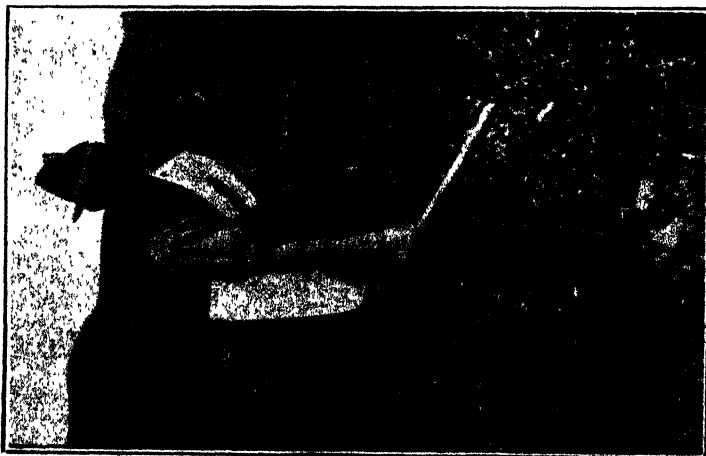


Fig. 4. Side view.



Fig. 5.] Rear view.

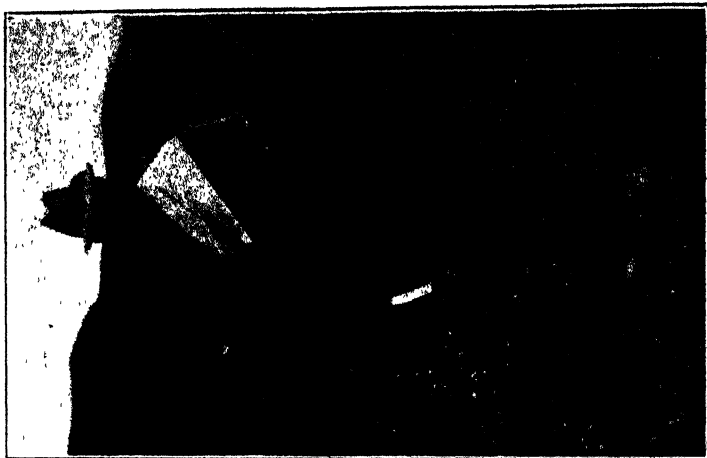


Fig. 6. Showing attachment across shoulder.

The great advantage of both devices is the cheapening of the actual distribution of manure on hill country by the increased acreage per day per man, freedom of the operator from inhaling dust—as under ordinary conditions this does not rise above the knees—and a continuous flow of manure, ensuring a much more even distribution than could possibly be obtained by the hand alone.

The accompanying photographs will give readers a good idea of the two distributors and their manipulation.

BUTTER-BOX TESTS.

THE “COOMBS” BOX.

W. C. WARD, New Zealand State Forest Service, Wellington.

THE results of a comprehensive series of tests upon butter-boxes in common use at the time were originally published in this *Journal* for May, 1926, and later reprinted as Circular No. 23 of the State Forest Service. As indicated in the previous article, the scope of the work was to be extended to allow of a later study of other types of butter-containers which might appear to promise improvement upon existing packages.

The first type of box to be so studied is known as the “Coombs” Patented Butter-box (N.Z. patent No. 56302), invented by Mr. H. Coombs, and manufactured by Messrs. Ellis and Burnand (Limited), of Hamilton. This box was thought to be worthy of close study, since its construction was theoretically sound, at the same time offering considerable economy both in the quantity and in the sizes of timber required, and in ease of handling. The results of the tests fully confirm these judgments, and the Coombs box can be recommended to shippers as a suitable package for the export trade.

BOXES TESTED.

The construction of the Coombs box is clearly shown in Fig. 1. The sides, top, and bottom form the unique feature of the box. Each piece consists of an inner coating of white-pine (*Podocarpus dactyloides*) veneer, $\frac{1}{4}$ in. thick, glued to and strengthened by four narrow battens, $1\frac{1}{4}$ in. wide by $\frac{3}{8}$ in. thick. The grains of the wood in the veneer and in the battens are disposed at right angles. Thus splitting of the sides, top, and bottom, which commonly causes the failure of the ordinary style 1 box, as shown in Fig. 2, is largely eliminated. In this respect it would resemble a box constructed of plywood. Furthermore, as the battens may be made from any timber with fairly good nailing-qualities, and are of narrow width, it follows that the Coombs box will assist to economize the supplies of non-tainting woods.

The inside dimensions of the boxes tested were $15\frac{1}{8}$ in. by $10\frac{1}{4}$ in. by 11 in., with a capacity of 1,706 cub. in. This is somewhat less than the capacity of the style 1 box (1,750 cub. in.) tested in the previous study, but is quite sufficient for packing the standard 56 lb. block during many months of the year.

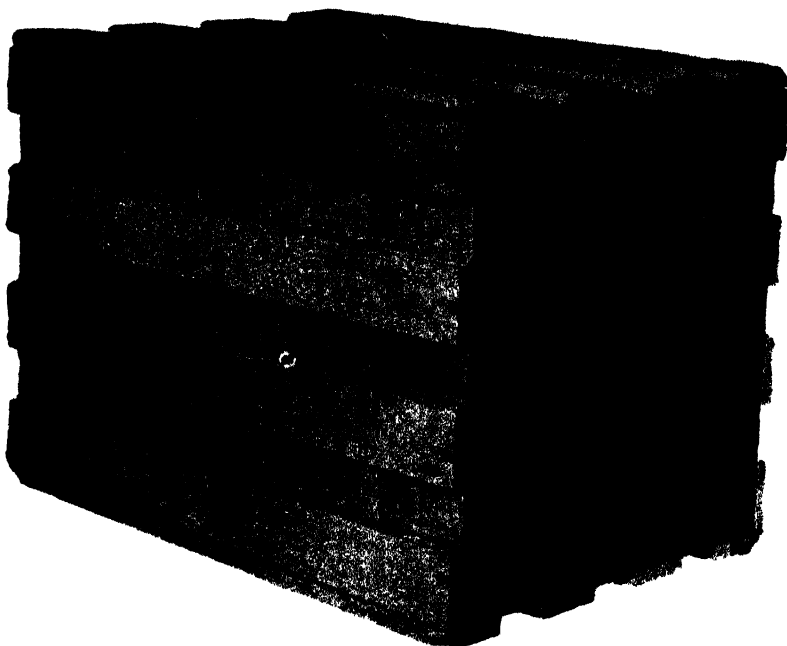


FIG. 1. COOMBS BOX UNBROKEN

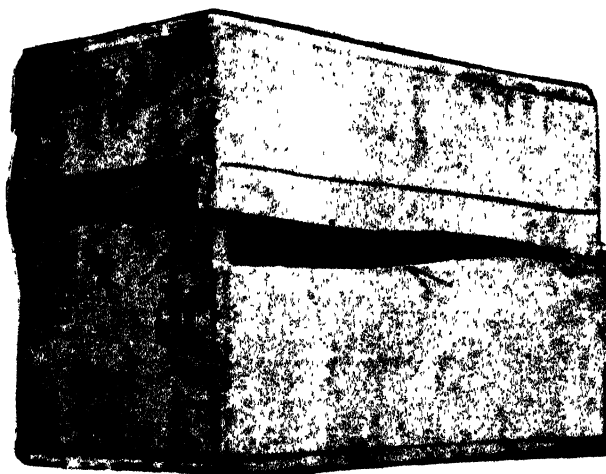


FIG. 2. TYPICAL FAILURE OF STYLE I BOX (UNSTRAPPED).
Splitting of sides has occurred early, causing box to collapse.

Two series of boxes were tested, one series of twelve being nailed up at the manufacturers' factory, the other of eight boxes at the Timber-testing Station, School of Engineering, Canterbury University College, Christchurch, where the tests were performed. Boxes fastened with ordinary and with cement-coated nails, and with and without Acme flat metal strapping centrally applied, were tested.

METHOD OF TEST.

The test used was the same as that employed in the previous study. The boxes were packed with 56 lb. of butter, as in commercial service, and placed in a hexagon-sided machine revolving slowly at a rate of $1\frac{5}{8}$ revolutions per minute. In the drum is arranged a series of hazards which cause the box to follow a regular cycle of drops, falling upon sides, top, bottom, ends, edges, corners, and flatwise upon a projection similar to the corner of another box. These drops simulate the usual hazards of transportation. Each face of the drum is counted as one drop. An illustration of the drum was printed on page 23 of last month's *Journal* in connection with the article on cheese-crate tests.

Results of Tests.

The results of the tests are shown in Table 1. The table also includes, for purposes of comparison, the results of tests upon the style 1 strapped box, with $\frac{3}{8}$ in. sides, top, and bottom, which was recommended to shippers as a result of the previous study. Both types of package have ends $\frac{1}{2}$ in. in thickness.

Table 1

Type of Box.	Number of Tests	Nails.		Straps	Number of Drops required to spill Contents
		Kind.	Number per Edge.		
Coombs - nailed at factory	2	Ordinary ..	4	Nil	42
	2	" ..	4	1	87
	4	Cement-coated	4	Nil	102
	4	" ..	4	1	138
Coombs — nailed at testing-station	3	" ..	4	Nil	504
	3	" ..	6	1	538
Style 1— $\frac{3}{8}$ in sides	5	" ..	5	1	342

When the boxes for the first series of tests were received it was clear that poor results would be obtained. Not only had the boxes been nailed up when the battens were partially dry, but the nails had been seriously overdriven, in cases by as much as $\frac{1}{8}$ in., as shown in Fig. 3. The tests, however, confirmed the results of the previous study, the superiority of the boxes fastened with cement-coated nails and reinforced with Acme flat metal strapping being clearly proved.

Typical failures of the strapped and unstrapped boxes are shown in Figs. 4 and 5. The weak feature in both types was the poor



FIG. 3. SHOWING SERIOUS OVERDRIVING OF NAILS IN FACTORY-NAILED COOMBS BOX.

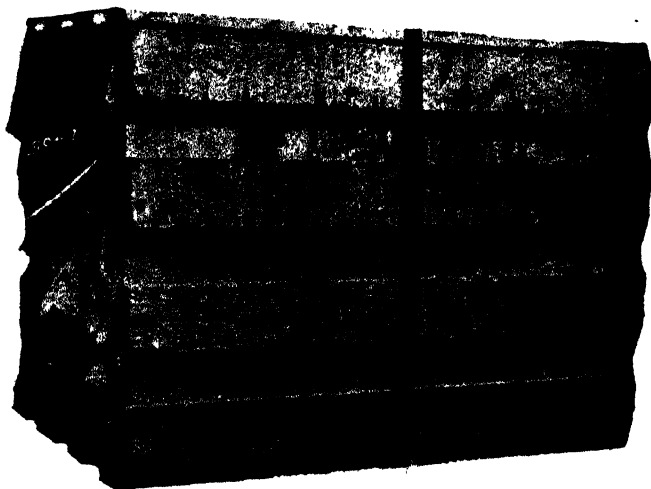


FIG. 4. TYPICAL FAILURE OF STRAPPED COOMBS BOX.

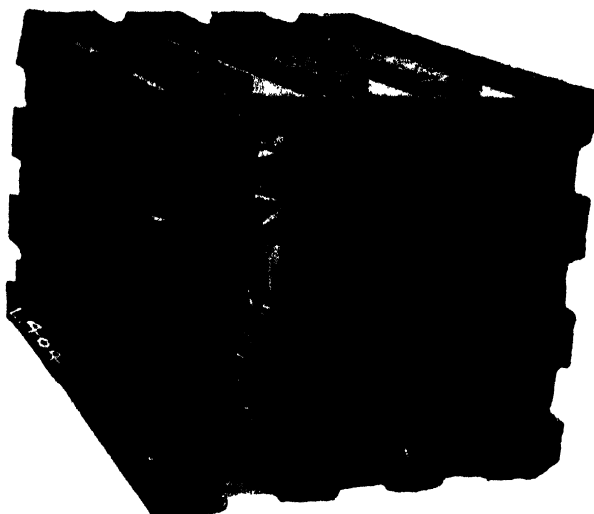


FIG. 5. TYPICAL FAILURE OF UNSTRAPPED COOMBS BOX

nailing. Immediately the nails loosened and pulled from the ends these latter failed by splitting and bursting, either allowing the box to come in two or exposing the contents to damage.

In the second series of tests the faults arising from the use of only partially air-dry timber and of the overdriving of nails were largely eliminated by careful inspection and assembly at the Timber-testing Station. Mr. Coombs, the patentee, was present throughout this series of experiments.

The first group of tests was made upon strapped boxes in which the two centre battens of each side, top, and bottom were attached at each end by two cement-coated nails, and the two outer battens by one cement-coated nail. The results indicated that the extra nailing was unnecessary, and that the strapping might be dispensed with. The second group of tests confirmed this conclusion.

The outstanding feature of the study was, indeed, the high strength developed by the unstrapped Coombs box fastened with cement-coated nails. This was considerably greater than that of the strapped style 1 box with sides, top, and bottom $\frac{3}{8}$ in thick as shown in Fig. 2. Since practical experience, however, has proved that the strapped style 1 box with sides, top, and bottom only $\frac{1}{8}$ in. thick is of sufficient strength for the export trade, it would appear that the Coombs box might be made of a lighter construction. One difficulty in this connection would be the driving of space nails attaching the top and bottom to the sides. It exists even in the present Coombs package, having been reported as a weakness in an experimental shipment of Coombs boxes forwarded to London at the beginning of the present season. The results of the tests augur well for the development of a butter-box having plywood sides; top, and bottom.

The study also demonstrated the importance of avoiding the use of only partially dry timber and the overdriving of nails. The unstrapped boxes of partially dry timber and with overdriven cement-coated nails of the first series exhibited less than one-fifth the strength of the same type of box constructed of well air-dried timber and properly nailed as in the second series.

SPECIFICATION.

Users of the Coombs box are recommended to adopt the following specification in the purchase of their supplies :—

Section A : General.

(1.) Definition : The box as herein specified shall be known as the "Coombs Butter-box," as covered by New Zealand patent No. 56302.

(2.) Dimensions : (a.) The inside dimensions of the box shall be $15\frac{1}{2}$ in. long by $10\frac{1}{2}$ in. wide by $11\frac{1}{2}$ in. deep. (b.) The width of ends, sides, top, and bottom shall be $11\frac{1}{2}$ in.

Section B : Manufacture.

(3.) Construction : (a.) The sides, top, and bottom shall each consist of an inner coating of a non-tainting wood (see clause 7 (a)) $\frac{1}{8}$ in. thick, glued to and strengthened by four battens, $1\frac{1}{2}$ in. wide by $\frac{3}{8}$ in. thick. (b.) The ends shall be of single-piece material $\frac{3}{8}$ in. thick if of white-pine or tawa, or $\frac{1}{2}$ in. thick if of silver-beech. (c.) The grain of the wood in the inner coating shall be disposed at right angles to that in the battens.

(4.) Manufacture : (a.) The ends, sides, top, and bottom of the box shall be well manufactured, and shall be cut true to size. All defects in the timber which materially lessen the strength of the part, or expose contents to damage, or interfere with proper nailing, shall be prohibited. (b.) The wood shall be thoroughly seasoned, and shall have a moisture content of not less than 10 per cent. nor more than 18 per cent., based on the weight of the wood after oven-drying to a constant weight. (c.) The variation in thickness of the boards below the thickness specified shall be not more than $\frac{1}{32}$ in., and this variation below the specified thickness shall not extend over more than 10 per cent. of the face of that particular board.

(5.) Jointing : Matched and glued or lock-jointed boards fastened with two galvanized corrugated fasteners, 1 in. by $\frac{3}{8}$ in., will be regarded as single-piece ends.

(6.) Surfacing : (a.) The outside surfaces of the sides, top, and bottom may be fine band-saw or veneered finish; otherwise they shall be smooth-planed. (b.) The ends shall be veneered or smooth-planed.

(7.) Timber : (a.) The following timbers will be admitted under this specification for use as ends and for the inner coating of sides, top, and bottom : White-pine (*Podocarpus dacrydioides*), silver-beech (*Nothofagus Menziesii*), tawa (*Beilschmiedia tawa*). (b.) Any timber with good nailing-qualities may be used for battens in the construction of sides, top, and bottom. A clear, whitish timber is preferable.

Section C : Nailing.

(8.) Nailing schedule : (a.) $1\frac{1}{8}$ in. cement-coated nails (i.e., nails coated with a resinous solution) shall be used when driving into white-pine ends, and $1\frac{3}{8}$ in. cement-coated nails when driving into beech or tawa ends. (b.) Nails shall be driven flush. (c.) The sides, top, and bottom shall be attached to the ends by not less than four nails per edge (i.e., one nail per batten at each end), and two spacing-nails per nailing edge of tops and bottoms.

Noxious-weeds Orders.—The Waikato County Council has declared foxglove, gorse, hakea, broom, and winged thistle to be noxious weeds within that county. The Waitaki County Council has declared gorse and broom not to be noxious weeds within the Ahuriri Riding of that county, except as to the county roads.

SEASONAL NOTES.

THE FARM.

LAYING DOWN PERMANENT PASTURE.

UNDER average conditions of land, locality, and climate March may be regarded as the best all-round period for laying down permanent pasture. Needless to say, the importance of this our dominant crop demands the greatest care in selection of the seed mixture and in the technique of sowing. Standard mixtures have frequently been formulated in the *Journal*, but these should be varied to suit the individual farm and accord with definite local experience.

When preparing the seed-bed care should be taken to secure a fine surface, so that the seed may be properly covered; also to make sure that the soil is firm underneath, in order to prevent the seed being buried too deeply. Grasses, moreover, root much better on a firm seed-bed. Where the land has been ploughed consolidation should be effected by plenty of rolling, the Cambridge roller being the best for this purpose. Where a rape, kale, or turnip crop has been fed off, and the land is reasonably clean, all that is necessary is to give a light disking to provide sufficient mould to cover the seed, preserving the consolidation that was brought about by the stock.

Various implements are used to cover grass-seed, but if the seed-bed is firm a light set of tine harrows will generally give best results. Chain harrows are frequently used, but they have a tendency to roll the seed into patches. The question of rolling after seeding must be decided on the condition of the land and local experience. Generally, if the land is dry and free it pays to roll; on the other hand, if it has a tendency to be wet and pack on the surface it is best left unrolled. Again, if the district or the season is subject to sudden heavy down-pours of rain it is advisable to finish with the harrows rather than the roller.

Generally, grass sown in March does best without a companion crop, but there are occasions when it is desirable to add something to provide a quick bite for stock or to shelter the young grass in very exposed positions. A bushel per acre of either Black Skinless or Cape barley or Algerian oats will be found suitable for these purposes.

FORAGE CROPS.

The sowing of forage crops for winter and spring feed should be pushed forward during the coming month. If the crop is to be cut and fed out in the early spring, Ruakura, or one of the white oats such as Gartons, will generally give the heaviest weight of material. March is usually a good month for sowing oats and tares or similar crops for spring feeding—later cutting them for ensilage or hay. Peas are at times used instead of tares, but they do not stand the feeding and the winter so well.

In the North the hardier varieties of soft turnip, such as Devonshire Greystone, may still be sown during March, and it is a good

plan to utilize land that has been fallowed by sowing a late turnip crop. Crops of maize and millet that have not been used should be fed off before April or else converted into ensilage. The stack method is quite suitable for the latter purpose. The combination of paspalum with these cereal crops in the ensilage stack is an improvement, and also affords an excellent means of keeping down the coarse rank growth on paspalum areas so often seen in autumn.

IMPROVEMENT OF POTATO STRAINS.

In most districts the main potato crop is lifted towards the end of March, and careful growers will be taking steps before then to improve their strains of seed. The following methods are commonly practised in Canterbury and other South Island districts, and have been found to give great satisfaction:—

(1.) Going through the crop and digging normal healthy shaws, the tubers of which are retained if the yield and type are also satisfactory. The tubers so produced are next season cut (all small ones being discarded) and planted in a seed plot or increase plot of a size to produce sufficient seed for planting the main crop in the following season.

(2.) Thoroughly roguing a definite area, thus eliminating all diseased and off-type plants. The tubers from this area are cut in due course (all small ones being discarded), and planted either as the main crop or in an increase plot as under the first method.

LUCERNE.

Spring-sown crops will generally be ready for a second cut about the end of March. This cutting should be followed by two or three strokes of the tine harrows or a light cultivator. After this cleaning process the practice may be recommended of drilling in $1\frac{1}{2}$ bushels of Algerian oats with 1 cwt. to 2 cwt. of super per acre. The oats will shelter the young lucerne, and help to control undesirable growths of grass and weeds.

Established stands that have not already had attention should be thoroughly cleaned up, and a filler may also be subsequently drilled in, using 1 bushel Algerian oats or 20 lb. Italian rye-grass, together with 2 cwt. basic super, per acre. If it is intended to take another cut from the lucerne after the end of March the sowing of the oats or rye-grass should be delayed until after this cut. Oats may generally be sown any time between the end of March and beginning of June, but up to the end of April for preference. The lucerne should always be cultivated just before the oats are sown.

BLUE LUPINS FOR GREEN MANURE AND SHEEP-FEED.

Blue lupins make an excellent crop for restoring land exhausted by continued cropping, at the same time providing useful winter forage for sheep. The lupins may be sown during the present month at the rate of $1\frac{1}{2}$ bushels per acre. If fed off the paddock may be ploughed about August, in preparation for spring-sown crops. Blue-lupin stubble rots very quickly in the ground, so that a long fallow is not necessary. If the whole green crop is ploughed in it is best to use a single-furrow plough with a drag-chain attached to the neck. As

green manure in light soil blue lupins serve as an excellent preparation for potatoes. In connection with feeding off, the sheep—ewes in particular—should be placed on at first for only a few hours at a time, and the crop fed off in breaks. After they have once become accustomed to the lupins, neither danger nor difficulty is commonly experienced.

AUXILIARY FEEDING OF DAIRY COWS.

On farms where supplementary forages are grown feeding will now be in full swing. If different fodders are available it is advisable to mix the ration as far as possible—say, soft turnips in the daytime and lucerne or maize at night, or lucerne in the morning and maize at night—so as to secure a proper balance. As far as possible all auxiliary feeding should be done immediately after milking. The farmer who feeds turnips, kale, or green lucerne just prior to milking is a menace to the factory output. Turnips should be pulled at least six hours before being fed. It is good practice to pull and put out in the afternoon for the following morning's feeding. If any grass is available, 60 lb. of turnips per cow per day should be the maximum. If larger quantities are fed the cow cannot digest them properly, and this is sure to be reflected in the milk-supply

—*Fields Division.*

THE ORCHARD.

SPRAYING.

FOR the control of the codlin-moth and leaf-roller caterpillar in mid-season and late varieties of fruit it will still be necessary in many localities to continue spraying with arsenate of lead. Pick and destroy regularly all codlin-infected fruits. At this period of the year conditions are frequently favourable for the development of black-spot, and therefore a careful watch should be kept in clean orchards to detect the first indications of this disease. In some localities this late infection often appears between the middle of February and the third week in March. Apply either lime-sulphur or bordeaux, according to the programme being followed. For powdery mildew cut off affected portions of twigs and shoots, and spray the trees with precipitated sulphur at 10 lb. to 12 lb. per 100 gallons. When red mite and apple-leaf hopper are in evidence apply lime-sulphur, 1 in 120, or Black Leaf 40, 1 in 800. Stone-fruits affected with any fungous disease should be sprayed, as soon as the fruit is gathered, with bordeaux, 3-4-50. Brown-rot infected fruits should not be allowed to lie about the ground, but be gathered up and destroyed.

DRAINAGE.

When opportunity offers the drainage of heavy retentive soils should be attended to, as badly-drained soil is not profitable orchard land. In well-drained land the soil is more congenial for the roots of the trees in the spring and during wet seasons than is the case in wet, cold, undrained land. Drainage allows of the land being worked

earlier in the spring, makes it easier to work down to a fine tilth, and also prevents the souring of the soil. Tile drains, though more expensive, are the most permanent type of drain, and give the best results in the orchard. The diameter of tiles for main drains should be at least 4 in. Soft boggy places in an orchard are often caused through seepage of water from a higher level, and in such cases a cross-drain of sufficient depth made above the orchard will usually cut off the seepage. After draining the land it should be well limed in the late autumn or early winter. Existing open drains should be cleaned out, and the outlets to pipe drains cleared so as to let the water pass freely away. Broken pipes should be replaced with new ones.

HARVESTING.

At this season of the year harvesting of the fruit crop will be engaging the attention of all orchardists. Mid-season varieties of pip-fruits will be ready or nearing the stage of maturity when they will be in a fit condition for picking for the respective markets or for storage. Picking and handling of fruit is a phase of orchard-work which requires a high degree of skill. The high percentage of loss and wastage due to bruises and skin-punctures caused at picking and in the subsequent handlings is much greater than it should be, and is striking evidence of the need of greater care in handling our fruit. A fact that should not be lost sight of is that the product of the year's work is being handled from which the return for the labour expended in the upkeep of the orchard is to be derived. A satisfactory realization is largely dependent on the condition in which the fruit reaches the market. Damaged fruit frequently opens up in a very unsatisfactory condition, with dark ugly bruises, with skin-punctures, and frequently badly decayed. Damaged fruit should be disposed of with as little delay as possible, and should not be placed in storage.

GRADING AND PACKING.

There is a good demand for well-graded and well-packed fruit. Fruit merchants, retailers, and consumers all want the best fruit, and there is an ever-increasing inquiry for this quality of fruit put up in a uniform manner. During the period of gluts in the markets well graded and packed consignments have always been disposed of at a satisfactory figure, while alongside, less carefully graded and packed consignments would not draw buyers when offered at very low prices.

Even grading is the basis of rapid packing, while uniformity in size, colour, and condition is the basis on which the buyer mainly decides the price he will give for the fruit. As to the best time to grade the fruit, some growers prefer to do most of it while picking, others do it in the orchard from the picking-buckets, while the majority grade in the packing-shed. Sizing would be greatly simplified if growers made three pickings, and on each occasion picked only mature fruit of nearly even size. In the larger orchards various types of graders are in use to obtain uniform sizing. Quality and colour grading should be combined with that of sizing.

In grading, no fruit with bruises, skin-punctures, skin broken at stem, disease, or other blemishes detrimental to the quality and appearance of the fruit, nor fruit which is too small, should be included. All fruits should be graded before being stored, so that fruit of any particular size and quality may be got at when required quickly and with a minimum of inconvenience.

The pack must be firm, so that the fruit is prevented from moving in the case. There should be little variation in the sizes of fruit used in the case, as the use of different sizes would cause the size and position of the pockets to vary and thus cause the loss of alignment, and even a change in the pack, which is most undesirable.

The first essential step in the improvement of the existing conditions in the industry is for all growers to pack to the standard set, and to keep the low grade and any small fruit they may have off the market. Growers who have not packed to this standard are urged to do so. The Orchard Instructor for the district will gladly advise and help in this matter.

MISCELLANEOUS.

Land intended to be planted out to fruit-trees in the autumn or spring should now be ploughed and left exposed to the weather in order to condition it for the reception of the trees.

Remove any superfluous shoots from trunks and limbs, so as to conserve the energy of the trees and direct the sap to other parts for the purpose of maturing shoots and buds necessary to the welfare of the tree.

Where the ties on trees grafted in the spring have not already been cut this should be done at once, so as to avoid any restriction of the sap and to prevent the tie cutting into and weakening it. The new growths should be protected to prevent them from being broken or blown off by the wind, &c.

—W. K. Dallas, *Orchard Instructor, Dunedin.*

Citrus-culture.

Work for the coming month will mainly consist in maintaining a clean state of cultivation, free from weeds, with the surface soil constantly worked to keep a depth of 3 in. or 4 in. of earth mulch.

Young shoots which become extended in growth beyond 18 in. should be pinched back to encourage side lateral growth; left to mature, these shoots often grow 3 ft. or more long before subdivision takes place, and then side laterals grow only on the extremity, leaving an undue length of wood unfurnished. By pinching out the point of these shoots as suggested, laterals are forced nearer the base, and growth encouraged where it is most useful, not where it is naturally disposed to grow.

Should young scales, thrip, or black aphid show up during this period an insecticidal spray of oil, 1-40, should be applied.

Where extended flowering of lemons has resulted in fruits which so far have not been sprayed, these should be sprayed with bordeaux, 3-4-40.

—W. H. Rice, *Orchard Instructor, Auckland.*

POULTRY-KEEPING.

DEVELOPING THE PULLETS.

PULLETS should now be placed in their winter quarters without delay. Changing the young birds from house to house just when they are on the point of laying, or even shortly afterwards, is only inviting the moulting process, with its concomitant loss of high-priced eggs.

It is essential that pullets should receive a plentiful supply of good nourishing food, with green material in abundance. The meat ration should, where possible, be given by itself at a regular time—say, at midday. When boiled meat is not available and meat substitutes have to be fed, these can be supplied sparingly with the morning mash. They may also be provided in a separate receptacle and left for the birds to consume at leisure as they desire. When including meat substitutes in the morning mash great care is necessary to guard against possible ill effects consequent upon over-indulgence in highly concentrated nitrogenous material. Ovarian troubles are almost sure to follow if the birds are overfed with meat-meal. Of course, when eggs are at a maximum price later on the pullets should be encouraged to give every egg they can, provided they are well developed and not unduly forced. Where pullets are showing signs of coming too rapidly to maturity, and promise to commence laying before they are sufficiently developed to enable them to lay a decent-sized egg and to last out a long profitable season, forcing diet such as meat should be withheld from the ration.

On no account should any sudden drastic change be made in the ration. There is no better way of forcing the pullets to moult now than by changing their food. Giving a feast one day and starvation diet another will have a similar effect. Regular and uniform attention is imperative if winter eggs are to be secured. In this connection I would advise those poultry-keepers who have a supply of last season's wheat on hand to conserve this for the pullets, as the changing from old wheat to new often has the effect of giving them a severe setback.

REGULAR CULLING ESSENTIAL.

Because the supply of eggs has been somewhat scarce of late, and likely to be for some time to come, a correspondent suggests that in order to prevent a further decline in production during the coming year I should, by medium of my *Journal* notes, and lectures both by myself and assistants, advise producers to retain all hens in their flocks, even although they have passed their second season of production. This I cannot see my way clear to do. It is well known that success in poultry-keeping depends mainly upon the manner in which its many details are attended to, but there is one essential detail which must be always kept in view before all others, and that is the weeding-out of unprofitable stock. The efficient poultryman who is really anxious to secure the greatest profit from his undertaking will not even leave culling to the end of the first laying season: he will cull all the time. He realizes that every poor layer retained in the flock means a drain on his profits. It

is not the number of birds kept that determines success, but the profit secured over the cost of production. Obviously, therefore, every drone, and the bird which has passed its best period of production, reduce the profits being made by those laying up to the mark.

It is now generally recognized—in fact, it has become an established maxim of the industry—that eggs must be produced in the dear season if the business is to be made really profitable. It also is recognized that the winter layers must be pullets bred at the right time and managed in the right way. Artificial incubation and brooding have passed the experimental stage, and no difficulty is now presented in securing sufficient pullets to replace at least a good part of the old stock each year. Even with the best of laying flocks only a few birds among the older stock will lay in winter. After the second laying season a bird will not only produce less eggs than formerly, but she will give these when the cheapest markets rule. Obviously, at the end of a bird's second laying-period sentiment should not be allowed to interfere with the work of culling. It is true that where only high-type layers are kept individual birds will be found which will pay to retain for a third laying season, especially a noted layer or a desirable breeding specimen. In a general way, however, these are few and far between. In any case, unless the poultry-keeper possesses the necessary keenness of eye to sort out the likely future producers from those having passed their normal profitable period, the suggestion to even restrict culling operations may easily prove a costly experiment.

Culling may even commence during the first few months of maturity, for it is useless to expect a weakly-constituted bird to make a profitable layer. Then again, there are always freaks or throw-backs from the best matings which will never develop into satisfactory stock. The point to remember is that it is a losing proposition to keep any bird which does not promise to return a good net profit. It may be said that the price of eggs suggests that even a medium layer will return a good profit over its keep, but it must be remembered that the prices of foodstuffs are correspondingly high. Thus regular culling is as essential to-day as ever before if maximum profits are to be made.

POINTS IN CULLING.

In a general way the main culling of laying flocks should be attended to in the coming month. Efficient culling is one of the chief secrets of successful poultry-keeping, and is one of the most difficult matters connected with poultry to teach the novice by printed matter. It is a work that can be successfully carried out only by a person possessing a cultivated eye for laying-type, and capable of making due allowances for the condition of the bird at the particular time the weeding-out process is taking place.

The time of moulting affords one of the best guides to constitutional vigour and laying-capacity. For a bird to give a high egg-yield she must necessarily be a long-season layer, and, obviously, to be a long-season layer she must be a late moulter, for it is only in exceptional cases that a bird will renew its feathers and at the same time continue laying. Thus with birds hatched at the same time, and which have been subjected to similar treatment in all

respects, the early moult is the bird that should be culled, and the late moult retained in the flock. It may be mentioned that in a mixed flock of first- and second-year layers (when the latter were selected the previous season because they were later moults) the second-year birds will usually, owing to their shorter season of production, moult later than those in their pullet year. In such cases, where the moulting-period is taken as a guide, due allowance for age must be made, otherwise many of the young birds which it would be profitable to keep are apt to be disposed of, and the older but less profitable members of the flock retained on the plant.

On all well-managed plants a mark or ring should be placed on every bird for age-determination and as a guide to culling unprofitable stock.

In addition to being a late moult, the high-type layer and the one likely to produce well in the future will present the following signs: A clean face free from feathers (it is not uncommon for the head and face to become quite bare—a sign seldom or never found in a low egg-producer); close feathering; a bright-red comb (which should be retained more or less throughout the moulting process); and an alert, vigorous appearance. Further, yellow-legged varieties will now present a bleached or, in fact, a white appearance. This sign will not be so pronounced where runs in long grass are available as when the ground is more or less bare, or when the birds are confined under cover. It must be noted that this leg sign only applies towards the end of a bird's productive season, for after it has moulted the legs will regain their yellow appearance, as is the case during the early pullet stage. The plumage of the heavy layer will also exhibit a worse-for-wear or rather shabby appearance, while the bird itself will be in a more or less lean condition.

All things being equal as to the time of hatching, &c., the birds that should be culled are those that are moulting, those with bright-yellow legs, those above the normal weight of their breed, those with feathered face and dull eyes, those with a specially well-kept plumage, and any which show the slightest weakness in constitutional vigour.

SELECTION OF THE BREEDING-HENS.

After the culls have been removed from the flock the remaining birds should be carefully gone through and a selection of hens made for next season's breeding-pens. It is specially important that this work be carried out now, as even with the best layers the points outlined as indicative to laying-power will not stand out prominently again for several months after the birds have undergone the moulting process. Birds selected for the breeding-pen should not only possess striking points indicative of laying-capacity and constitutional vigour, but in addition they should conform to standard weight requirements, and be at least a fair specimen of the breed they represent. Small diminutive specimens should not be bred from, no matter how well they may have laid.

The selected birds should be placed by themselves and given a plain ration, with the object of discouraging them from laying in the meantime. Where every egg is forced out of the late moults and intended breeders it is safe to assume that trouble is being laid in store, and will be met with later in the hatching and rearing of the

progeny. Where possible the proposed breeders should be given a free range, and, above all, care should be taken that they are prevented from getting overfat between now and when they are to be called upon to lay eggs for reproductive purposes. Breeding from overfat hens is a common cause of poor hatches and the production of chicks that are difficult to rear.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

BEE-ESCAPES.

FOR removing honey late in the season the beekeeper may find it necessary to bring into use bee-escapes. These escapes enable the honey to be removed without causing any disturbance. By the employment of the Hodgson escape device there is less likelihood of causing robbing, with its attendant evils. More especially will the escapes be found advantageous when removing section honey from the hive. There is far more risk in removing sections from the hive than extraction-combs. When the colony is disturbed the bees will at once start to fill their sacs, and often the cappings of the sections are punctured in order to secure a supply of honey. The damage to the cappings of sections is unsightly, and causes the honey to leak after removal from the hive. The special advantage of the Hodgson escape is that, being constructed of wire gauze, the heat from the brood-chamber is not shut off from the super after the bees have escaped. Thus the honey in the super is kept warm, and the drips of honey from the burr combs are cleaned up by the bees.

When inserting the Hodgson escape the super should be gently prized up from the brood-chamber and the escape placed in position. A puff of smoke will suffice to control the bees while the operation is being performed. If this is done late in the afternoon the bees will pass through the escape during the night to the brood-nest, and will be unable to return. In the morning the supers may be removed, when practically no bees will be left in the super.

A word of caution to those who have not formerly used the escapes: Should there be brood in the super combs the bees will not leave, and the escapes will not prove effective in ridding the supers. Over and over again many beginners complain that they cannot get the bees to leave the supers when using escapes, but the reason lies in the fact that no examination had been made to ascertain beforehand whether the super contained honey only.

UNITING COLONIES.

Among the autumn work to be attended to is the examination of the colonies for the purpose of ascertaining if each possesses a laying queen, and to note those that are too weak to survive the winter. In the negative in either case it is advisable to unite with a stronger colony so as to save the bees. On no account should an attempt be made to winter weak hives, as they are likely to get robbed out, and this may cause the bees to start robbing when everything in the apiary should be quiet. A simple method of uniting may be practised by placing the weaker hive on top of a stronger one, and placing a

sheet of newspaper between the two hive-bodies. In the course of a few days the bees of the weaker colony will make their way through the paper and unite peaceably with the bees in the stronger hive. The surplus combs may subsequently be removed and reserved for spring feeding if required. It is advantageous to destroy the queen in the weak hive prior to uniting.

ROBBING.

At the close of the honey-flow the beekeeper must persistently guard against robbing. Robbing is the result of carelessness, and once it has started is exceedingly hard to check. As previously mentioned, neither honey, sugar-syrup, nor anything that the bees can rob should be exposed. In case wet combs have to be returned to the hives for the bees to clean up, postpone this operation until late in the day, when robbing is not likely to start. See that the honey-house is bee-proof, and that all combs and vessels containing honey are removed to a place of safety. Contract all hive-entrances, and especially guard against hives being open in such a way that they can be attacked by robbers. All operations must be carried out quickly. If robbing has started, it is better to postpone all outside work until the apiary is quiet again than to risk extending the trouble by opening the hives. Should a colony be attacked, contract the entrance and pile wet grass in front of the hive. This will usually cure mild cases of robbing; but where a colony has been overpowered by the robbers it should be closed altogether.

—E. A. Earp, *Senior Apiary Instructor.*

HORTICULTURE.

SYSTEM IN TOMATO-CULTURE.

CONSIDERABLE losses have been incurred in the tomato crop this season through black-stripe disease, early blight (*Alternaria*), and sclerotinia. The main cause in many instances has been due to unnecessary checks in growth which the plants have received in the frames and when first planted out, the debility thus caused resulting in the plants falling an easy prey to any disease to which they were exposed. Too much stress can hardly be given to this cause, as besides the losses from disease another result is the small and late crop produced.

An unprepared potting-soil for the seed-boxes and pricking out, and an overdose of nitrogenous manures on the land before planting out, are probably the other main causes of these losses. A suitable potting-soil is best obtained by at this period placing in a stack the top spit of a piece of good grassland on which tomatoes have not been grown for some years. In twelve months this can be turned and some basic slag or other manures added, and it will be in good condition for the following season—that is, about eighteen months from the present date. This procedure may sound rather tedious, but it is one of the fundamentals of successful tomato-culture, and in large-scale production it is unsafe to do otherwise. It follows that such potting-soil as may be in hand should now have any further manures

that may be required mixed in, and the compost placed under cover to mature ready for the new season commencing in June next.

SMALL FRUITS.

Where strawberries and other small fruits are to be planted the preparation of the land should now be completed, and a heavy dressing of bonemeal or other well-decayed organic manures ploughed in deep in time for it to be well incorporated before planting takes place. Although the land for this class of crop requires to be moist and deep, it is important that there should be no standing water at any time on or near the surface. The heavy dressings of fertilizers which are customary do more harm than good where drainage is insufficient. For this reason hedges in the vicinity should now be trimmed well back and the open drains cleaned out.

Where the old canes of loganberries and raspberries have not yet been cut out they should now be removed and burnt. They are usually diseased to some extent, and, if left, communicate the disease to the young canes and make successful spraying difficult. An observance of these precautions will reduce cane-wilt, anthracnose, and leaf-spot disease.

THE VEGETABLE GARDEN.

In the colder Southern districts the cabbage crop for cutting in early spring may be planted out towards the end of this month, but the operation is best deferred for a while in the warmer localities, as if the plants are too forward before winter they are then inclined to bolt as soon as the ensuing spring commences. The celery crop must not be allowed to dry out, but should be irrigated where necessary, and suitable fertilizers applied to induce steady growth; blanching should be commenced when the plants are three-parts grown. Lettuce-seeds may be sown now for winter crops. Seed of white onions, also the main onion crop where the system of planting out the bulbs in spring is adopted, should also be sown.

This season's onion crop will now be approaching maturity, and when the falling tops indicate that stage as having been reached they should be lifted. To defer the operation is to depreciate the appearance and keeping-qualities of the bulbs. After being allowed to dry for a while they are turned by drawing a number of rows together with wooden rakes into one row, and when drying is completed they are trimmed, graded, and bagged into cental bags. During this process they are easily bruised, and so require careful handling. No attempt should be made to store for a long period anything but medium-sized, firm, well-ripened bulbs, and these must not be piled to cause heating, but be placed in a dry, airy shed. Bulbs of this quality may be very profitable if properly stored. Keen judgment of condition and careful grading are required for profitable marketing.

HARVESTING POTATOES.

The main potato crop also will be approaching maturity, and when the drying shaws readily leave the tubers when pulled they should be promptly lifted. As this crop has to stand long storage and transport, it is advisable for the tubers to be ripe before lifting; to leave them longer in the ground is detrimental. Each day's digging should be bagged and stored as lifted, the pickers being carefully supervised in grading for size and the elimination of the least sign of

disease. Whether the tubers are stored in a pit, shed, or the shelter of a plantation, the requirements are dark, cool, humid, and airy conditions. Under dry conditions they lose weight and quality; too much light will green them; and frost will readily cause injury. Every care taken in the selection of seed tubers is well repaid. Without careful selection the strain rapidly deteriorates. It is important that the shaws be immediately raked up and burnt, and preparation made for the following crop.

THE TOBACCO CROP.

The later-planted tobacco crop will now commence to ripen, and it is desirable, if possible, to harvest the leaf when in good condition, during a period of bright, fine weather; the leaves are then very different from the thin, limp foliage during warm rains, when heavy transpiration is taking place and the desirable properties in the leaf are at a discount. Cut the plants when the dew has dried off them, and arrange for such transport to the curing-shed as will avoid any of the leaves being torn and bruised.

The curing of the early crop will be nearing completion, and when that is attained it may be stripped. The early execution of this operation will provide more accommodation in the curing-sheds, which is usually badly needed. Cured tobacco-leaf is very sensitive to temperature and moisture. When dry it is exceedingly brittle, and to handle it then is to cause wholesale damage and loss. In a humid atmosphere, however, it absorbs moisture rapidly and becomes soft and pliable, and may be freely handled. This may be brought about by introducing steam, or opening ventilators and admitting a humid atmosphere, which may be further assisted by sprinkling the floors. *When the desired condition is obtained*, the sticks with the cured plants on them may be taken down and the leaves carefully stripped from the stalks, graded, and tied into hands of about a dozen leaves, and rehung in the shed. The terms "stemming" and "stripping" are sometimes used for another operation, which should be noted, as the confusion of terms is the cause of a great deal of misunderstanding. The operation is one sometimes done by the shipper, but more often now in the factory, and consists of the removal of the midrib of the leaf itself, leaf so treated being commonly known as "strips."

The class of grading adopted will depend on the variety of tobacco and the market in view, but nothing will establish that confidence which is the foundation of good business quicker than a steady observance of the grades laid down. If priming has not been done in the field—that is, the bottom leaves removed—these should be discarded now, as they are invariably thin, torn, and useless. The top leaves also are in some varieties and circumstances small and immature, and are best discarded into the waste, which may be used for making insecticide sprays. This avoids a lot of unnecessary handling and freights, which are a consideration nowadays.

The hands of tobacco when rehung must be kept dry and reasonably warm, or moulds will become troublesome and cause depreciation, for which reason open sheds or unlined iron sheds are unsatisfactory at this stage. If suitable accommodation cannot be given, the goods should be despatched as soon as the butts of the leaf-stems have thoroughly dried out.

SOWING OF LAWNS.

Where lawns are to be sown the land should now be clean and in good tilth. Present work is to rake and roll the ground till a firm smooth seed-bed is obtained. If the land has had time to settle this will be more easily accomplished, otherwise there is some difficulty in getting rid of the small potholes in the surface, but levelling should proceed until this is accomplished. A smooth, well-graded grass surface is by no means the least attractive feature in the garden. In the process of levelling and filling-in it often happens that the depth and quality of the soil are variable. At a casual glance this may not be obvious now, but when the sward is established it becomes conspicuous and is very disfiguring. Filling depressions with rich soil and suchlike methods should be avoided.

When the surface is satisfactory, and the bed even and firm, rake up a fine shallow tilth and sow the seed ; 1 oz. to 2 square yards will generally be a good dressing of an average mixture of lawn-grass seed. The seed should then be well raked in, and the job is completed. Needless to say, none of this work should be done when the soil is at all wet and sticky.

—W. C. Hyde, Horticulturist.

TESTING OF PUREBRED DAIRY COWS.

JANUARY CERTIFICATE-OF-RECORD LIST

Dairy Division.

THE appended list gives particulars of certificates issued in January—all pertaining to records gained in 1926. Owing to delays on the part of breeders in completing formalities, a considerable number of 1925 records are still outstanding, but it is expected to publish a closing list of these in next month's *Journal*.

LIST OF RECORDS.

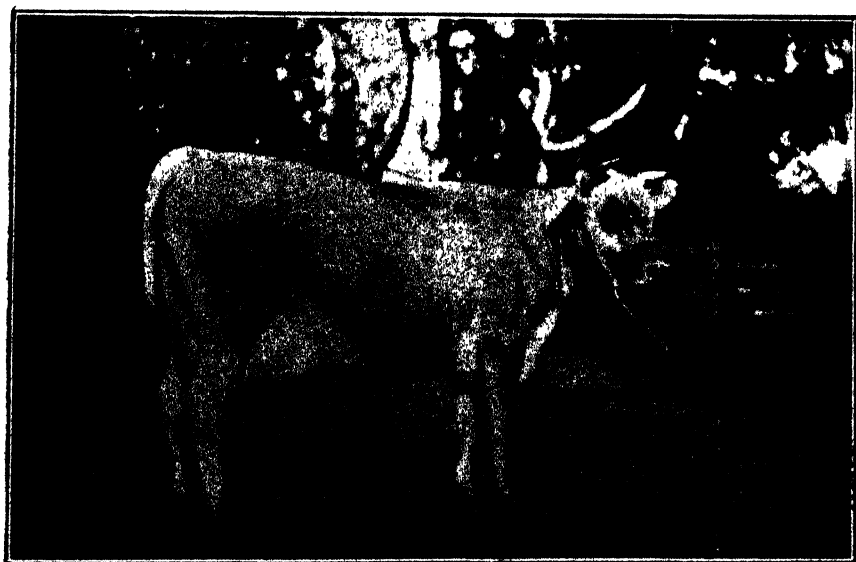
* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.		Yrs. dys	lb.		lb.	lb.
Lady Ailsa ..	J. Murray, Woodville ..	2 56	246.1	305	9,704.8	588.56
So Ladylike ..	F. V. Bryant, Ruawhata ..	2 12	241.7	305	10,762.9	550.65
Waipiko Caution ..	S. H. Wearing, Richmond..	2 35	244.0	305	9,795.2	540.84
Sybil Aldin ..	F. V. Bryant, Ruawhata ..	2 1	240.6	305	10,421.9	534.04
Riverswood Gem ..	J. Nicolson, Kaupokonui ..	2 11	241.6	305	9,414.8	528.01
Rosy Creek Queen ..	J. Murray, Woodville ..	2 52	245.7	305	10,810.4	510.52
Twylsh						
Perfection of Glenmore ..	A. C. Lovelock, Woodville..	2 16	242.1	305	9,805.7	484.41
Riverswood Peggy ..	J. Nicolson, Kaupokonui ..	1 215	240.5	305	7,085.5	430.92
Uruti Brown Heath ..	W. Oxenham, Uruti ..	2 14	241.9	305	7,883.9	434.91
Erinview Bonnie Lass ..	J. Murray, Woodville ..	2 21	242.6	305	9,365.5	427.35
Glenmore Delight ..	A. C. Lovelock, Woodville..	2 26	243.1	305	7,039.8	423.19
Kelvin Veronica ..	G. Buchanan, Paeroa ..	1 265	240.5	305	6,227.5	321.55
Kelvin Plush ..	G. Buchanan, Paeroa ..	2 13	241.8	305	6,432.5	316.87
Orange Dale Sylvia ..	W. J. Hall and Son, Matatoki	2 53	245.8	314	5,704.5	307.18



TIKITERE (F. S. MCRAE, PALMERSTON NORTH).

C.O.R. in Jersey mature class : 12,054.2 lb. milk, 746.94 lb. butterfat.



FUKATERE (DAUGHTER OF TIKITERE, AND ALSO TESTED BY MR. MCRAE).

C.O.R. in senior two-year-old Jersey class : 8,181.6 lb. milk, 523.71 lb. butterfat.

LIST OF RECORDS—continued.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS—continued.						
<i>Senior Two-year-old.</i>		Yrs. dys.	lb		lb.	lb.
Proud Duchess ..	G. Hodgson, Whakapara ..	2 349	275·4	250	5,797·0	318·27
<i>Three-year-old.</i>						
Beresford Belle ..	T. Brownlee, Pukekohe ..	3 50	282·0	321	6,617·4	429·35
Glyndyfrdwy Goldie ..	W. J. Hall and Son, Matatoki	3 324	309·4	332	6,264·0	343·57
Lady Pansy Dudley ..	G. Walker, Maunu ..	3 121	289·1	354	4,962·0	331·80
<i>Four-year-old.</i>						
Briar's Gift ..	F. Phillips, Otorohanga ..	4 40	317·0	365	11,940·8	683·69
Pear Jam ..	G. Hodgson, Whakapara ..	4 345	348·0	365	8,219·2	443·96
Silverdale Golden Hope	G. Hodgson, Whakapara ..	4 352	348·7	296	7,457·0	414·07
<i>Mature.</i>						
Abberley Naomi ..	G. Walker, Maunu ..	6 38	350·0	365	11,868·3	603·23
Crofton's Nancy ..	A. J. Luxton, Omata ..	7 76	350·0	333	8,954·9	511·60
Rewa Maycan ..	G. Walker, Maunu ..	7 10	350·0	365	8,535·1	509·61
Orange Dale's Olga ..	W. J. Hall and Son, Matatoki	6 21	350·0	343	9,119·3	503·96
Fair View Light ..	G. Walker, Maunu ..	5 70	350·0	327	6,930·1	380·51
FRIESIANS.						
<i>Junior Two-year-old.</i>						
Omaha Tui Burke Paxton	A. Migounoff, Matakana ..	2 94	249·9	339	12,966·4	452·84
Totara K.P. Rosona ..	Piri Land Co., Auckland ..	2 136	254·1	204	10,160·2	420·80
Omaha Hilda Nobeltje	A. Migounoff, Matakana ..	2 35	244·0	339	10,832·9	418·99
Lichfield 23† ..	W. J. Polson, Fordell ..	2 7	241·2	303	10,217·6	340·52
Lichfield 25† ..	W. J. Polson, Fordell ..	2 35	244·0	351	10,531·2	319·48
<i>Senior Two-year-old.</i>						
Omaha Nobeltje Paxton	A. Migounoff, Matakana ..	2 359	276·4	276	11,419·3	441·35
<i>Junior Three-year-old.</i>						
Omaha Tamara Rex	A. Migounoff, Matakana ..	3 178	294·8	342	13,881·3	496·31
Lichfield Violet† ..	W. J. Polson, Fordell ..	3 181	295·1	365	11,981·1	397·91
<i>Senior Four-year-old.</i>						
Omaha Van Vola 2nd	A. Migounoff, Matakana ..	4 324	345·9	356	12,971·1	539·01
<i>Mature.</i>						
Cloverlands Mary† ..	W. J. Polson, Fordell ..	6 345	350·0	365	14,988·0	564·85
Meadow Lily de Kol of Ashlynn†	W. J. Polson, Fordell ..	11 340	350·0	365	14,888·6	519·04
Maud Corona Beets ..	W. H. Madill, Auckland ..	5 86	350·0	274	16,996·1	501·96
Brookfield Abbecker Jessie	A. Migounoff, Matakana ..	5 295	350·0	272	9,708·7	404·77
Second-class Certificates.						
Jerseys.						
<i>Junior Two-year-old.</i>						
Ku Ku Snowdrop ..	R. L. Horn, sen., Ohau ..	2 0	240·5	365	9,092·6	437·34
Beaulieu Exile's Lilac	G. Walker, Maunu ..	1 313	240·5	365	4,397·7	267·21
Friesians.						
<i>Junior Two-year-old.</i>						
Lichfield 27 ..	W. J. Polson, Fordell ..	1 364	240·5	365	14,126·7	484·47

THE NEW DAIRY-PRODUCE REGULATIONS.

MANUFACTURE AND EXPORT.

(Continued from January.)

Grading of Cream supplied to Creameries or Whey-butter Factories.

18. (1.) As soon as practicable, but in no case more than three hours, after the arrival at any creamery of any whole-milk cream supplied thereto the owner of such creamery shall grade such cream, or cause it to be graded, in accordance with the standards set out in clause 25, into one or other of three classes to be known as finest, first grade, and second grade respectively.

(2.) Where two or more lots of cream arrive at a creamery mixed together, the grading of such lots may be based on examination of samples, provided the following provisions are complied with: (a.) Each sample shall be of not less than half a pint. (b.) The sample shall be taken from a lot before it is mixed with any other lot. (c.) Each sample shall be taken by a responsible agent appointed in that behalf by the owner of the creamery. (d.) Each sample shall be left until grading in a separate bottle so marked as to indicate the particular lot from which it was taken.

(3.) In all other cases the grading shall be based on examination of the cream as delivered.

(4.) Notwithstanding the provisions of subclause (1) of this clause the owner of any such creamery may, in lieu of grading any lot or lots of cream at the creamery, grade such lot or lots at any dairy registered as a cream-receiving depot, provided the provisions of this clause are complied with in all other respects.

19. Payment to each supplier of such whole-milk cream shall be so made that the rate shall be at least one halfpenny per pound of butterfat more for cream graded as finest than for that graded as first grade, and at least one penny per pound of butterfat less for cream graded as second grade than for that graded as first grade.

20. As soon as practicable, but in no case more than three hours, after the arrival at any whey-butter factory of any whey cream supplied thereto the owner of such factory shall grade such cream, or cause it to be graded, in accordance with the standards set out in clause 26, into one or other of two classes to be known as first grade and second grade respectively.

21. Payment to each supplier of such whey cream shall be so made that the rate shall be at least one penny per pound of butterfat less for whey cream graded as second grade than for that graded as first grade.

22. All such whole-milk cream or whey cream containing less than thirty-five per centum, by weight, of butterfat shall be paid for at a rate one halfpenny per pound of butterfat less than the rate that would otherwise have been payable for it according to its grade.

23. In every case where payment for such whole-milk cream or whey cream is made by way of more than one part-payment, any adjustment in the rate of payment required to be made under clauses 19, 21, or 22 hereof shall, in connection with each lot of such cream, be made on the first part-payment made in respect of such lot.

24. All relevant books and records of the owner of every creamery or whey-butter factory shall be kept available for examination by any Inspector, or by any officer of the Department of Agriculture authorized by the Director in that behalf, for the purpose of ascertaining all particulars of payments made for such cream; and any Inspector or any officer so authorized may at any time make such examination after giving written or oral notice to the owner of his intention so to do.

25. The following shall be the standards for grading whole-milk cream supplied to any creamery:—

"Finest" shall be cream that is clean in flavour, of uniform consistency, and free from appreciable defects in all other respects.

"First grade" shall be cream that is almost clean in flavour, is of uniform consistency, and is free from serious defects in all other respects.

"Second grade" shall be cream that is below first-grade quality but suitable for the manufacture of butter for human consumption.

26. The following shall be the standards for grading whey cream supplied to any whey-butter factory :—

"First grade" shall be whey cream of that quality which in the opinion of the cream-grader would, if manufactured separately by the method usual in the Dominion, yield "first-grade" whey butter.

"Second grade" shall be whey cream of that quality which in the opinion of the cream-grader would, if manufactured separately by the method usual in the Dominion, yield whey butter below "first grade."

27. Should any cream-grader allot to any whole-milk cream or whey cream any points intended to indicate its quality, he shall so allot the same points as would, in his opinion, be allotted by a Grader to butter made from the said cream if manufactured separately by the method usual in the Dominion, allowing in respect of matters not dependent on the quality of the cream the number of points that might reasonably be expected to be allotted by a Grader to such butter.

28. (1.) After the expiration of two months (or such longer period as the Minister shall by notice in the *Gazette* appoint in that behalf) from the commencement of these regulations every person who grades any cream in compliance with clauses 18 or 20 shall hold a cream-grader's certificate

(2.) Every person desiring to obtain a cream-grader's certificate shall make application therefor in writing to the Director.

(3.) Such application shall be accompanied by a certificate of character from the applicant's present or last employer or some other reputable person.

(4.) Such application shall set out the following particulars with relation to the applicant: (a) His full name; (b) his postal address; (c) the date of his birth; (d) his educational attainments; (e) his experience in dairying; and (f) the name of the creamery or whey-butter factory at which he intends to grade

(5.) If such certificate is desired for use immediately on the expiration of the period referred to in subclause (1) of this regulation, the application shall be made within one month after the coming into operation of these regulations.

(6.) In every other case the application shall be made at least fourteen days before the applicant proposes to commence grading

(7.) The Director, on being satisfied that the applicant has passed such examination as the Director considers necessary, and is otherwise a fit and proper person to grade cream, shall, as soon as practicable, issue to him a cream-grader's certificate as required by this clause.

(8.) Every such certificate shall be signed by the Director, and shall be in the form No. 4 in the Schedule hereto, and shall remain the property of the Department, and shall be surrendered forthwith to the Director by the holder on written notice in that behalf.

(9.) Whenever any cream-grader has failed to grade any cream on behalf of the owner of a creamery or whey-butter factory during six consecutive months his certificate shall thereupon cease to be in force, and the holder shall forthwith return it to the Director.

(10.) If at any time the Director is satisfied that the holder of any cream-grader's certificate is no longer a fit and proper person to grade cream, the Director may give him written notice to surrender his certificate. Upon receipt of such notice such certificate shall cease to be in force.

(11.) The Director shall cause a register to be kept of the names of all persons to whom cream-graders' certificates have been granted and are from time to time in force, and entries shall be made therein of any matter whereby a certificate ceases to remain in force.

(12.) A copy certified by the Director of any entry in the register shall be *prima facie* evidence of such entry and of the facts appearing therein, and a certificate under the hand of the Director of the absence of an entry in the register shall be *prima facie* evidence of the facts stated in such certificate.

(13.) No person who is not registered as the holder of a cream-grader's certificate for the time being in force, or who is the holder of any such certificate that ought to have been returned to the Director, shall, after the expiration of the time specified in subclause (1) of clause 28, grade any cream supplied to a creamery or whey-butter factory.

(14.) Every cream-grader shall produce on request at any reasonable time his cream-grader's certificate for inspection by an Inspector or by any supplier of cream to the manufacturing dairy at which he grades cream.

29. Every cream-grader shall, at the close of each week or part-monthly testing-period in which he has graded any cream, forward to the Director, or to the officer of the Department of Agriculture appointed by the Director in that behalf, a signed and dated return showing, with respect to all cream graded by

him as second grade during the week or part-monthly testing-period, the name of the creamery or whey-butter factory, the name and address of the supplier of the cream, the date of grading, the weight in pounds of second-grade cream received from each supplier, and the percentage graded as second grade of the total weight of cream graded at such respective creamery or whey-butter factory during the period to which the return relates. It shall be sufficient compliance with the requirement in regard to the percentage mentioned if the cream-grader attaches to his return a statement of the said percentage signed by or on behalf of the owner of the creamery or whey-butter factory.

30. No cream-grader shall knowingly assign to any cream any grade other than its true grade according to the standards set out in clauses 25 and 26; and no person shall falsify any record of the grading of, or of the payment for, any cream supplied to any creamery or whey-butter factory.

Contaminated or Decomposing Milk or Cream.

31. (1.) No person shall deliver, or send for delivery, to any manufacturing dairy, and no owner of any dairy shall accept delivery of or use for manufacture, any milk or cream which contains or has contained any animal, bird, maggot, or other thing making it unfit for the manufacture of a product for human consumption, or any milk or cream affected by putrefactive decomposition.

(2.) Should any such milk or cream as aforesaid be delivered to any manufacturing dairy, the owner of such dairy shall forthwith add to such milk or cream a sufficient quantity of methyl violet to effectively colour the whole of it.

(3.) Any Inspector may in like manner and in any place wheresoever add methyl violet to any such milk or cream as aforesaid which in his opinion is intended or likely to be used or manufactured for human consumption.

Manufacture of Cheese.

32. (1.) No person shall incorporate in any cheese during its manufacture any inferior curd or cheese.

(2.) No person shall deliver, or send for delivery, to any factory or private dairy for manufacture into cheese any milk to which any cream has been added, unless with the previous consent in writing of the owner of such factory or private dairy.

(3.) The shape and size of any kind of modified-milk cheese shall be as approved from time to time, and no person shall manufacture any kind of modified-milk cheese in a shape or size not so approved.

Maturity of Cheddar Cheese.

33. Every owner of a registered dairy in which Cheddar cheese is manufactured shall keep all such cheese on shelves for at least fourteen days before packing it, or allowing it to be packed, for sale or export, and during such period shall turn each cheese upside down once a day.

Protection of Whey from Contamination.

34. (1.) No whey for use in the manufacture of food for human consumption, or from which cream is to be separated for such use, shall be brought into direct contact with any pipe, channel, tank, or other conveying or holding appliance made of wood, of concrete, or of iron, whether galvanized or not.

(2.) No such whey shall be conveyed or held except in conveyers or holders having a smooth and hard surface impervious to moisture.

Manufacture of Whey Butter.

35. If any owner of a dairy mixes or allows to be mixed cream or butterfat recovered from whey with cream or butterfat separated from milk for the purpose of manufacturing butter therewith, the resulting product shall be deemed to be whey butter for the purposes of these regulations.

36. Immediately after being separated whey cream shall be heated to a minimum temperature of 176 degrees Fahrenheit, and shall thereafter be forthwith cooled to a temperature not exceeding 65 degrees Fahrenheit, and after being so cooled shall be kept at a temperature not exceeding 65 degrees Fahrenheit until churned or delivered from the factory as whey cream.

37. No matter from cheese-presses, whether white whey, washings, butterfat, or other matter, shall be used in the manufacture of whey butter.

38. All piping used for the conveyance of whey for separating for the purpose of manufacturing whey butter shall be erected in easily handled lengths, suitably joined together with such couplings as will facilitate expeditious dismantling.

39. The internal parts of all pumps used for the pumping of whey prior to its being separated for the purpose of manufacturing whey butter shall be of some metal other than iron, and all such pumps shall be so constructed as to be readily dismantled.

40. (1.) Every owner of a whey-butter factory shall comply with the requirements of clauses numbered consecutively from 36 to 39 hereof (inclusive) so far as they relate to such whey-butter factory.

(2.) Every owner of a manufacturing dairy shall keep, exhibit to any Inspector on demand, and supply to the Director whenever he so requests, accurate daily records of the number of pounds of each of the following dealt with in such dairy :

(a) Butterfat in cream separated or recovered from whey ; (b) butterfat purchased in the form of whey cream ; (c) butterfat in cream which has been separated from milk and added in making whey butter ; (d) butterfat contained in milk added to whey cream ; and (e) whey butter manufactured from such butterfat as is referred to in subparagraphs (a), (b), (c), and (d) of this clause.

Branding and Marking.

41. (1.) Before sending or allowing to be sent any butter other than milled butter to an appointed grading-store the owner of the butter shall plainly mark with stencil or rubber stamp on every package a number to indicate whether the butter was included in the first, second, third, or other specified churning (as the case may have been) of the day of its manufacture, also a number to indicate the day of the month on which the butter was manufactured. The said numbers shall be in plain figures not less than $\frac{3}{4}$ in. nor more than 1 in. in height.

(2.) Before sending or allowing to be sent any milled butter to an appointed grading-store the owner of the butter shall plainly mark with stencil or rubber stamp on every package a number to indicate whether the butter was included in the first, second, third, or other specified mulling (as the case may have been) of the day on which it was milled, also a number to indicate the day of the month on which the butter was milled. The said numbers shall be in plain figures not less than $\frac{3}{4}$ in. nor more than 1 in. in height.

(3.) Before sending or allowing to be sent any cheese to an appointed grading-store the owner of the cheese shall plainly mark with stencil or rubber stamp on every package the word "white" or "coloured," as the case may require ; the consecutive number of the package ; a number to indicate whether the cheese was included in the first, second, third, or other specified vat (as the case may have been) of the day of its manufacture ; and a number to indicate the day of the month on which the cheese was manufactured. The word "white" or "coloured" shall be in block letters $1\frac{1}{4}$ in. in height and $\frac{1}{4}$ in. in thickness of line, and all the said numbers shall be in plain figures not less than $\frac{3}{4}$ in. nor more than 1 in. in height.

42. (1.) Before sending or allowing to be sent from his manufacturing dairy any butter or cheese, the owner of the dairy shall cause every package to be clearly and indelibly branded with his brand as registered by the Director, and with respect to such brand the following provisions shall apply. (a.) The brand shall consist of a die-impression, or of some other kind of approved brand coloured as hereinafter provided. (b.) Such die-impression or brand shall, according to the class of dairy and the kind of produce, be in such one of the forms 5 to 10 in the Schedule hereto as is applicable : Provided that the form may be varied in such manner as is approved, but so nevertheless that the particulars specified in the form in the Schedule are clearly set out. (c.) The owner of every factory or private dairy shall cause each cheese manufactured therein to be, within twenty-four hours of its first removal from the cheese-hoop, clearly and indelibly branded with—(i) his registered brand by means of a stencil or rubber-stamp ; and (ii) the vat-number of the cheese and the number of the day of the month on which the cheese was manufactured.

(2.) The owner of a manufacturing dairy shall in every case where branding is required by this clause use the appropriate brand so as correctly to indicate the class of dairy-produce to which it refers.

43. No person shall export, or attempt to export, or be concerned in exporting, any butter or cheese that is in packages which do not bear in clear and indelible figures the true net weight of the contents at the time of grading.

44. All branding and marking in the case of milled butter, whey butter, dairy butter, dairy cheese, or modified-milk cheese (except actual shipping-marks) shall be in red colour, and all branding in the case of other classes of dairy-produce shall be in some dark colour other than red.

National Brand.

45. Upon each end of every package containing creamery butter or full-cream factory cheese for export graded as finest or first grade shall be placed the national brand described in clause 49.

46. No person shall export or cause or permit to be exported in a package bearing the national brand any butter or cheese other than creamery butter or full-cream factory cheese graded as finest or first grade unless the national brand has been first cancelled by means of an indelible stamp-impression approximately 6 in. long and 2 in. wide and consisting of seven red bars each approximately 6 in. long and $\frac{1}{4}$ in. wide.

47. The national brand shall be used in conjunction with the marks and brands provided for in subclause (1) or (3) of clause 41, subparagraphs (a) and (b) of subclause (1) of clause 42, and clause 43.

48. The national brand shall be so placed on any package by means of an impressed die, or by some other approved means, and shall be coloured in the same manner as the brands provided for in clause 44.

49. The national brand shall consist of a design of a fernleaf, bearing the words "New Zealand," substantially in the manner shown in the form numbered 11 in the Schedule hereto.

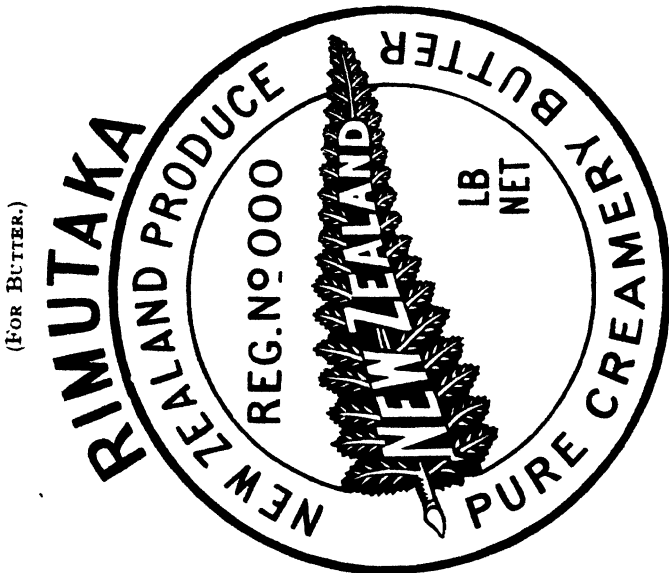
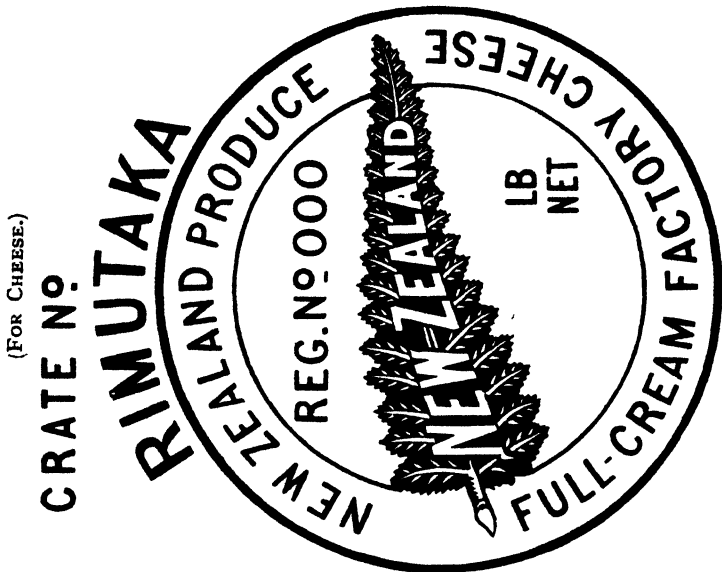
General Prohibitions as to Branding and Marking.

50. (1.) For the purpose of this clause the branding or marking of dairy-produce shall be deemed to extend to and include the branding or marking of any package containing dairy-produce.

(2.) It shall not be lawful—(a) For the owner of a registered dairy to allow his registered brand to be used for the purpose of branding any dairy-produce that has been manufactured elsewhere than in his registered dairy: (b) for any person other than the owner of a registered dairy to use such owner's registered brand for the purpose of branding any dairy-produce that has been manufactured elsewhere than in such registered owner's dairy: (c) except in the case of the owner of a registered dairy, and in accordance with these regulations, for any person to brand any dairy-produce with the words, or any combination or abbreviation of the words, "New Zealand," "Creamery," "Factory," "Dairy," or "Whey": (d) for the owner of a registered dairy to include in his registered brand, or for any person to stamp or mark on dairy-produce for export, any words indicative of high quality, such as "Choicest," "Choice," "Superfine," or "Superior": (e) except as provided for in these regulations, for any person to use or cause or permit to be used any words, figures, characters, design, or other marks whatever within the outermost limits of the space occupied by the brands, words, figures, and marks other than date, vat, and churning numbers, required by these regulations to be placed upon any package containing or intended to contain dairy-produce for export.

Standard Export Butter-boxes.

51. No person, whether as principal or agent, shall, excepting with the prior written consent of the Minister, export, or pack for export, beyond New Zealand any butter except in standard boxes—that is to say, rectangular boxes complying with the following requirements: (a.) The inside dimensions shall be 15½ in. long, 10½ in. wide, and 11½ in. deep, and the sides, tops, and bottoms shall be of timber ½ in. in thickness; or (b) the inside dimensions shall be 15½ in. long, 10½ in. wide, and 10½ in. deep, and the sides, tops, and bottoms shall be of timber less than ½ in. in thickness. (c.) The minimum thickness of the ends of all boxes other than those of the Saranac type shall be (i) ½ in. if of silver-beech, or (ii) ¾ in. if of timber other than silver-beech. (d.) The outside measurements and the binding shall be as approved. (e.) The ends, sides, tops, and bottoms shall be single pieces of timber; provided that matched boards, glued or lock-jointed together, shall be regarded as single pieces. (f.) The ends shall be planed smooth on the outside, or of veneer finish. The outer surfaces of the sides, tops, and bottoms, and the inner surfaces of the ends, shall be planed smooth, cut with a fine band-saw, or of veneer finish. (g.) The timber shall all be well seasoned, and free from cracks, loose knots, pockets of resin, and other defects capable of allowing the contents to suffer damage. (h.) No nails other than cement-coated nails shall be used. (i.) The outsides shall be clean.



FORM II (REG. 49) : THE NATIONAL BRAND.

Standard Export Cheese-crates.

52. No person, whether as principal or agent, shall, excepting with the prior written consent of the Minister, export, or pack for export, beyond New Zealand any Cheddar cheese except in standard crates—that is to say, crates which (a) are suitable to contain two full-cream cheeses of approximately eighty pounds weight each; (b) have twelve sides of which each contiguous pair forms a similar angle; and (c) comply with the following requirements: (i.) The ends shall be of timber planed smooth on the outside, and shall, after dressing, be not less than $\frac{7}{8}$ in. thick. Each crate shall have a centre board, which shall be not less than $\frac{7}{8}$ in. thick. The ends and centre boards shall measure not less than 15 in. between each opposite pair of sides. (ii.) The sides shall be made of battens, which shall be $27\frac{1}{2}$ in. long, not less than 3 in. nor more than $3\frac{1}{2}$ in. wide, and not less than $\frac{3}{4}$ in. nor more than $\frac{1}{2}$ in. thick; the outer edges of the battens shall be chamfered. The height of the cheese shall be such as will allow of an air-space $\frac{1}{2}$ in. deep at one end of each cheese; and all cheese shall be so crated that each shall have over the whole of one of its ends an air-space of at least the aforementioned depth. Each batten shall be secured to each end board and to the centre board with cement-coated nails. (iii.) The crates shall be bound at each end and at the centre either with non-rusting wire secured with staples or with other approved binding. (iv.) The timber shall all be well seasoned, and free from cracks, loose knots, pockets of resin, and other defects capable of allowing the contents to suffer damage. (v.) One or more scale-boards shall be placed at each end of each cheese. (vi.) The outsides shall be clean.

Wrapping Butter for Export.

53. No person, whether as principal or agent, shall, excepting with the prior written consent of the Minister, export, or pack for export, beyond New Zealand any butter unless it is wrapped with two thicknesses of vegetable-parchment paper of the best quality and weighing not less than twenty-eight pounds per ream. Such parchment paper shall be free from loading with glucose or other soluble matter.

(To be continued.)

OCCUPATION AND UTILIZATION OF LAND.

THE following table summarizes the condition of occupied land in New Zealand for 1925 and 1926:—

	1925.	1926.
	Acres.	Acres.
Orchards, market gardens, vineyards, nurseries, and seed-gardens	32,747	32,433
Crops	1,768,303	1,645,719
Area occupied by residences, outbuildings, gardens, &c.	63,206	64,872
Fallow land	124,459	135,355
Sown grasses	16,450,625	16,615,960
<i>Phormium tenax</i> (New Zealand flax)	54,814	57,780
Tussock and other native grasses	14,470,990	14,298,618
Fern, scrub, &c.	4,054,760	4,165,576
Plantation	71,218	88,656
Standing virgin bush	4,331,333	4,176,569
Barren and unproductive land	2,209,917	2,325,291
Totals	43,632,372	43,606,829

In this table "barren" land is defined as that which is incapable of being put to profitable use, and not merely that which is barren because unused. Types of this land are mountain-tops, cliff-faces, shingle-beds, &c. It must be recalled that this table does not profess to give the condition of all land, as the total area of the Dominion is 66,390,262 acres, whilst the area occupied in 1925 was returned as 43,632,372 acres—a difference of 22,757,890 acres.

—Census and Statistics Office.

LICENSED MEAT-EXPORT WORKS IN NEW ZEALAND, SEASON 1926-27.

Name and Address of Company. <i>Land District.</i>	Name and/or Location of Works	Beef-killing Capacity Per Day.	Sheep- killing Capacity Per Day.	Storage Capacity, in 60 lb. Carcases Mutton
<i>North Auckland and Auckland.</i>				
Auckland Farmers' Freezing Company, Ltd., Auckland	Moerewa ..	200	2,000	100,000
" " "	Southdown ..	200	3,000	202,000
" " "	Horotiu* ..	200	3,000	218,000
Westfield Freezing Company, Ltd., Auckland ..	Westfield ..	250	3,000	205,000
R. and W. Hellaby, Ltd., Auckland ..	Westfield ..	120	500	3,000
<i>Hawke's Bay.</i>				
Thomas Borthwick and Sons (Aus.), Ltd., Christchurch ..	Pakipaki ..	30	1,800	70,000
Nelsons (N.Z.), Ltd., Tmoana ..	Tomoana ..	150	5,000	180,000
Hawke's Bay Farmers' Meat Company, Ltd., Hastings ..	Whakatu ..	80	4,000	80,000
Wairoa Farmers' Co-operative Meat Co., Ltd., Wairoa ..	Wairoa ..	100	3,000	165,000
<i>Gisborne..</i>				
Nelsons (N.Z.), Ltd., Gisborne ..	Waipaoa ..	150	3,500	270,000
Gisborne Sheep-farmers' Frozen Meat and Mercantile Company, Ltd., Gisborne	Kaiti ..	150	4,000	422,000
Ditto ..	Tokomaru Bay ..	60	3,000	140,000
" ..	Hicks Bay* ..	75	1,500	60,000
<i>Taranaki.</i>				
Thomas Borthwick and Sons (Aus.), Ltd., Waitara ..	Waitara ..	200	2,000	80,000
J. A. Hutton (N.Z.), Ltd., Wellington ..	Eltham ..	60	..	25,000
Patea Farmers' Co-op. Freezing Company, Ltd., Patea	Patea ..	150	2,000	180,000
<i>Wellington.</i>				
New Zealand Refrigerating Company, Ltd., Christchurch	Imlay ..	200	6,000	271,000
Otaihape Farmers' Meat and Produce Co., Ltd., Taihape	Winiata* ..	50	1,200	90,000
Felding Farmers' Freezing Company, Ltd., Feilding ..	Aorangi ..	100	4,000	153,500
National Mortgage and Agency Company of New Zealand, Ltd. (Head Office, Dunedin)	Longburn ..	60	2,000	100,000
Wairapa Frozen Meat Company, Ltd., Masterton ..	Waingawa ..	120	5,000	150,000
Gear Meat Preserving and Freezing Company of New Zealand, Ltd., Wellington	Petone ..	100	10,000	300,000
J. A. Hutton (N.Z.), Ltd., Wellington ..	Ngahauranga ..	120	3,000	120,000
Wellington Meat Export Company, Ltd., Wellington ..	Ngahauranga ..	120	8,000	240,000
" " "	Kakariki* ..	100	2,000	00,000
<i>Marlborough and Nelson.</i>				
New Zealand Refrigerating Company, Ltd., Christchurch	Picton ..	30	2,000	30,000
Nelson Freezing Company, Ltd., Nelson ..	Stoke ..	30	500	50,000
<i>Canterbury.</i>				
Canterbury Frozen Meat and Dairy Produce Export Com- pany, Ltd., Christchurch	Belfast ..	120	6,000	252,000
Ditto ..	Fairfield ..	..	4,000	100,000
" " "	Parera ..	25	4,500	233,000
New Zealand Refrigerating Company, Ltd., Christchurch	Islington ..	50	7,000	375,000
" " "	Smithfield ..	50	6,000	304,000
North Canterbury Sheep-farmers' Co-operative Freezing Company, Ltd., Christchurch	Kaiapoi ..	100	4,000	222,000
Thomas Borthwick and Sons (Aus.), Ltd., Christchurch ..	Belfast ..	..	5,000	120,000
<i>Otago.</i>				
Waitaki Farmers' Freezing Company, Ltd., Oamaru ..	Pukeuri ..	..	3,500	230,000
New Zealand Refrigerating Company, Ltd., Christchurch	Burnside ..	50	3,500	216,000
South Otago Freezing Company, Ltd., Balclutha ..	Fineland ..	50	2,500	200,000
<i>Southland</i>				
Ocean Beach Freezing-works (J. G. Ward and Co., Ltd., Managing Agents), Invercargill	Ocean Beach ..	50	2,500	110,000
Southland Frozen Meat and Produce Export Company, Ltd., Invercargill	Mataura ..	50	2,500	104,000
Ditto ..	Makarewa ..	120	2,500	75,000
Tait's Woodlands Meat Company, Ltd., Invercargill ..	Woodlands† ..	..	..	..
Totals ..	..	3,870	138,500	6,515,500

* Not operating, season 1926-27.

† Canning only.

—Live-stock Division.

WEATHER RECORDS : JANUARY, 1927.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE outstanding feature of January's weather was the heat-wave that obtained in the latter half of the month. This long, dry spell caused most parts of the Dominion to show rainfall totals well below the average for the month. The exceptions were principally owing to minor disturbances chiefly affecting certain localities. For instance, in the first week of January there were thunderstorms in parts on the 2nd and 6th, accompanied by heavy downpours; and in the same period a cyclonic disturbance passed off East Cape, bringing highly beneficial rainfall to the east coast of the North Island.

A widespread disturbance ruled between the 10th and 16th, but it was of small intensity, and accounted for more general rainfalls, especially in the west-coast and southern districts of the South Island.

The early part of the month was good for crops and growth of grass; but the warm and dry period in the latter half affected the pasturage, particularly on light land.

RAINFALL FOR JANUARY, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.
<i>North Island.</i>				
	Inches.		Inches.	Inches.
Kaitia	4.24	11	1.10	3.36
Russell	4.81	9	2.00	4.54
Whangarei	3.34	10	0.98	3.63
Auckland	1.46	9	0.36	2.66
Hamilton	1.83	9	1.06	3.94
Kawhia	1.70	7	0.62	3.37
New Plymouth	2.63	11	1.24	4.40
Riversdale, Inglewood	5.47	11	1.81	7.43
Whangamomona	3.91	9	1.24	5.82
Tairua	4.26	10	0.90	4.12
Tauranga	4.18	14	1.78	4.34
Maraehako Station, Opotiki	2.10	10	1.12	2.87
Gisborne	0.50	7	0.31	2.97
Taupo	0.50	3	0.27	3.46
Napier	1.54	6	0.54	3.18
Maraekakaho Station, Hastings	2.74	9	0.85	2.29
Taihape	3.01	10	1.21	3.28
Masterton	1.16	7	0.58	2.69
Patea	2.15	7	1.09	3.38
Wanganui	3.68	5	2.36	2.84
Foxton	1.20	9	0.42	2.30
Wellington	0.68	9	0.22	3.30
<i>South Island.</i>				
Westport	6.84	14	2.33	6.80
Greymouth	9.28	16	3.50	9.04
Hokitika	10.30	14	2.73	9.87
Ross	15.72	12	4.95	12.04
Arthur's Pass	15.45	10	3.66	6.75
Okuru, Westland	13.79	17	2.33	12.86
Collingwood	4.07	8	1.53	6.95
Nelson	2.18	6	1.39	2.82
Spring Creek, Blenheim	0.68	2	0.46	2.22
Tophouse	3.42	9	1.95	5.14
Hammer Springs	2.23	8	0.80	3.77

RAINFALL FOR JANUARY, 1927—continued.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average January Rainfall.
<i>South Island—continued.</i>				
	Inches.		Inches.	Inches.
Highfield, Waiau	1·40	4	1·08	2·84
Gore Bay .. ..	..	..	..	2·47
Christchurch	0·62	7	0·25	2·21
Timaru	0·92	7	0·40	2·30
Lambrook Station, Fairlie ..	1·28	5	0·64	2·34
Benmore Station, Clearburn ..	0·95	7	0·23	2·66
Oamaru	0·85	8	0·52	2·11
Queenstown	3·94	7	1·40	2·71
Clyde	1·29	5	0·74	1·72
Dunedin	3·18	15	1·26	3·36
Wendon	2·68	10	1·60	3·52
Gore	4·04	16	1·69	3·28
Invercargill	3·29	20	0·58	4·01
Puysegur Point	7·08	18	2·74	7·22

—D. C. Bates, Director.

ESTIMATED YIELDS OF WHEAT AND OATS.

THE following estimated average yields per acre of wheat and oats for the season 1926-27 have been compiled by the Government Statistician from reports furnished by Inspectors of the Department of Agriculture throughout the Dominion, and issued under date 8th February, 1927.—

District.	Wheat Bushels per Acre.	Oats. Bushels per Acre.
North Island	32·40	38·91
Nelson	28·01	33·00
Marlborough	29·56	29·73
Canterbury	33·85	43·76
Otago	34·08	42·89
Southland	36·71	45·83
Average (estimated) for the Dominion, season 1926-27	33·92	43·86
Average (actual) for the Dominion, season 1925-26	30·44	40·14

In accordance with the above estimates, the total yield of wheat for the Dominion should be approximately 7,500,000 bushels, as against an actual yield of 4,617,041 bushels for the season 1925-26.

The percentage of oats threshed for the five seasons ending with 1925-26 was 27·40 of the total area under that crop. Assuming that a similar proportion is threshed this year, the total yield of grain should be approximately 4,900,000 bushels, as against an actual yield of 4,115,606 bushels for the season 1925-26.

CENSUS OF POULTRY, 1926.

THE usual census of poultry taken synchronously with the census of population in April, 1926, gave the following results (the figures for the preceding census of 1921 being added in parentheses for purposes of comparison): Fowls, 3,308,000 (3,492,000); ducks, 352,000 (380,000); geese, 44,000 (46,000); turkeys, 77,000 (73,000); total poultry, 3,781,000 (3,991,000). It will be seen that all classes except turkeys have decreased since 1921.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

AGE FOR CASTRATION OF COLTS.

J. K., Te Poi :—

Would you please inform me if it makes any difference at what age a colt is castrated—say, for instance, at three to five months old or fourteen or fifteen months old? Those who advocate the latter age say it allows the animal to develop more shoulder. Is that so?

The Live-stock Division :—

The advocates for castration at the age of a year or fifteen months are correct in their view that the animal will develop more male characteristics—such as thick shoulders and a high, coarse crest—than if done as foals. Where colts are found to be ewe-necked, or otherwise badly developed, castration may be delayed for one or even two years for the purpose of allowing them to furnish up. The usual age for the operation is round about a year, this having been found to be the most practical for all purposes.

HOME-MADE BUTTER FOR LONG KEEPING.

E. QUINN, Upper Hutt :—

Would you please give me a recipe for preserving butter?

The Dairy Division :—

When home-made butter is required to be kept for a considerable time special care should be taken in the making. The cream should be fresh and sweet, or only very slightly sour. The butter should be churned to small granules, and the latter washed quite clear of buttermilk. Salt should be added at the rate of not less than $\frac{1}{4}$ oz. per pound of butter. More can be added if desired, but the keeping-quality of the butter will not be enhanced by the additional salt. The butter should be stored in a cool place. The lower the temperature of the storage the longer the butter is likely to keep good.

THE GREEN CHAFER AND PASTURE.

“TANGATAROA,” Ashburton :—

I would be glad to know whether the green beetles, slightly smaller than the grass-grub beetle, that abound on manuka-trees in the daytime are harmful to pastures. I have not previously seen them so numerous.

The Fields Division :—

The green beetle (*Pyronota festiva*) is a chafer, and belongs to the same group as the common grass-grub (*Odontria zealandica*). The green-beetle larvæ certainly do a considerable amount of localized damage to pasture both in wet and dry ground.

DERANGEMENT IN FILLY.

F. B., Wakanui :—

I have a well-grown two-year-old filly in good condition. About five weeks ago she began to lose control of her hind legs when walking or galloping—wobbling them sideways and very uneven. Later her front ones have gone likewise. She otherwise appears to be in good health, and has been grazing in good paddocks with plenty of clover and grass. Can you recommend any treatment?

The Live-stock Division :—

The symptoms mentioned point to a nervous derangement, the actual cause of which is difficult to indicate without seeing the filly. A practical examination is an essential factor in most such cases. The following treatment is suggested : (1) Take the filly off the paddock she is now running in ; (2) administer 1 pint of raw linseed-oil ; (3) feed 3 lb. crushed oats daily (1½ lb. each feed), adding to this a tablespoonful of salt daily ; (4) run her in another paddock—a poorer one for preference.

GRASS-SEED MIXTURE FOR THAMES DISTRICT HIGH BUSH COUNTRY.

A. F. R., Thames :—

Would you kindly suggest a grass-seed mixture for the following class of country in the Thames district : It is 2,500 ft. above sea-level, very dense bush, rather broken, and very wet all through the year, and second growth comes away very quickly. We get very poor burns, and the only grass that seems to hold at all is brown-top.

The Fields Division :—

The following mixture is advised for the country and situation stated : Perennial rye-grass, 6 lb. ; brown-top, 2 lb. ; paspalum, 3 lb. ; *Danthonia pilosa*, 2 lb. ; *Poa pratensis*, ½ lb. ; crested dogtail, 4 lb. ; *Lotus major*, 1 lb. ; white clover, 1 lb. ; subterranean clover, ½ lb. ; yarrow, 1 oz. ; total, 20 lb. 1 oz. per acre.

FOWL-MANURE.

F. L. FOSTER, Lyttelton :—

Will you kindly give me some information on fowl-manure ? I am drying it, and then putting it through a bone-crusher and grinding it up fine. Would it be good for vegetables and flowers ?

The Horticulture Division :—

Fowl-manure contains a very high percentage of nitrogen and phosphates. It is a concentrate of great value in the garden, and may be used at the rate of 5 cwt. to 10 cwt. per acre (2 oz. to 4 oz. per square yard) when preparing the land ; or light dressings may be given to growing crops as required. Your method of treating it is quite correct.

COW WITH CRACKED HOOFS.

H. L. McDONALD, Marton :—

I should be glad if you would give me information as to the best treatment for cracking in the hoofs of a cow. The animal has been on dry country, but the cracks seem to be spreading. No matter is being discharged.

The Live-stock Division :—

This condition usually arises through faulty secretion of the horn, resulting in brittleness of the hoof. We would advise you to apply a little of the following dressing to the feet twice a week : Mutton-fat, one part ; Burgundy pitch, one part ; tar, two parts. Melt the fat and pitch over a slow fire, then add the tar, and mix thoroughly.

Share System in Dairying.—The share system in New Zealand (states the Census and Statistics Office) is practically analogous to the system of *melayage*, which is common in some countries. Holdings worked on the share system are treated in the agricultural and pastoral statistics as if leased by the share worker. In New Zealand the owner provides land, stock, and implements, the share worker supplying the labour and receiving a definite proportion of the product of his labour.

FAIR PACKING OF FRUIT AND VEGETABLES.

THE regulations relating to the packing of strawberries, loganberries, raspberries, and cherries for sale, gazetted, on 12th September, 1924, were revoked, and the following more comprehensive regulations issued in their place, by Order in Council gazetted on 20th January, 1927—on which date they came into force:—

1. For the purposes of these regulations, unless the context otherwise requires, "fruit" means the unmanufactured edible product of any orchard or garden plant, and includes potatoes, onions, tomatoes, and all other vegetables.

2. All fruit sold, or offered or exposed for sale, whether wholesale or retail, in a container shall be packed in such a manner that any fruit exposed to view, or that would be exposed to view if the container were opened in the normal manner, fairly represents in size, maturity, and condition the whole contents of the container.

3. All strawberries, loganberries, raspberries, or cherries sold, or offered or exposed for sale, in containers of a capacity not exceeding 3 lb. net weight of the fruit contained therein shall be so packed that the container is full of fruit.

4. Nothing in these regulations shall be held to prohibit "facing"—that is to say, the methodical arrangement of the individual fruits that are exposed to view in a container—provided the requirements of clause 2 hereof are complied with.

5. Every person commits an offence against the Orchard and Garden Diseases Act, 1908, who directly or indirectly, by himself, his servant, or agent, fails faithfully to observe and perform any duty or obligation imposed on him by this Order in Council, and is liable to a fine not exceeding £20.

FORESTRY LEAGUE COMPETITION FOR JUVENILES.

THE New Zealand Forestry League is again offering prizes for collections of the foliage, flowers, and fruit of native trees, for boys and girls (1) over twelve and under sixteen years, (2) under twelve years: three prizes in each class. Specimens are to be of not less than twelve different trees and twenty different shrubs, and must have been collected since July, 1926. All collections of merit will be exhibited at the annual meeting of the League. Collections must reach the Secretary, New Zealand Forestry League, Dominion Farmers' Institute, Wellington, on or before 11th June next. All particulars of prizes, conditions, &c., may be obtained from the Secretary.

BOOKS RECEIVED.

AGRICULTURAL RESEARCH IN 1925. Published by the Royal Agricultural Society of England, 16 Bedford Square, London W.C. 1. 2s. 6d.

PLANT NUTRITION AND CROP PRODUCTION. By Sir John Russell. University of California Press, Berkeley, U.S.A. \$ 2.50.

THE INDIVIDUALITY OF THE PIG. By Robert Morrison. John Murray, Albemarle Street, London W. 1. 7s. 6d.

NEW ZEALAND OFFICIAL YEAR-BOOK, 1927. Compiled in the Census and Statistics Office. Government Printer, Wellington. 7s. 6d.

NATIVE DIET. By Ettie A. Rout; with preface by Sir W. Arbuthnot Lane, President of the New Health Society. Wm. Heinemann (Medical Books), Ltd., 20 Bedford Street, London W.C. 2. 6s.

Rabbit Districts.—An Order in Council gazetted on 13th January declared Part III of the Rabbit Nuisance Act to be no longer in operation in the Kahuwera Rabbit District.

Honey-grading Ports.—New Plymouth has been substituted for Wanganui on the list of export honey-grading ports.

CONTROL OF DOWNY MILDEW AND PHYLLOXERA IN VINES.

THE following regulations under the Orchard and Garden Diseases Act were gazetted on 13th January, 1927, and came into force on that date —

1. For the purposes of these regulations, unless inconsistent with the context, "Inspector" means any Inspector appointed under the Orchard and Garden Diseases Act, 1908; "prescribed area" means all that portion of New Zealand comprising the counties of Eden, Waitemata, Rodney, Otamatea, Hobson, Whangarei, Bay of Islands, Hokianga, Whangaroa, and Mongonui, and all boroughs and town districts enclosed by or adjacent to the said counties, or any of them; "vine" means any vine of the genus *vitis*, and any portion thereof excepting the fruit; "fungus" means the fungus known as downy mildew; "insect" means the insect known as phylloxera vastatrix.

2. No person shall remove any vine, fungus, or insect from any portion of the prescribed area to any other portion of New Zealand.

3. No person shall remove any vine bearing fruit, leaves, or immature wood, or which has earth adhering to its roots, or any fungus or insect, from any portion of the prescribed area to any other portion thereof: Provided that the provisions of this clause shall not be held to prohibit the removal of vines within the boundaries of the property on which they are growing.

4. No person shall remove any vine from that portion of the prescribed area comprising Waitemata County to any other portion of the prescribed area, unless accompanied by a certificate signed by an Inspector declaring that such vine has been disinfected as directed by him and to his satisfaction.

5. Nothing in these regulations shall be deemed to apply to an Inspector in respect to his sending any vine, fungus, or insect beyond the boundaries of the prescribed area for the purpose of the identification of disease.

6. Every person commits an offence against the above-mentioned Act who directly or indirectly, by himself, his servant, or agent, fails faithfully to observe and perform any duty or obligation imposed on him by this Order in Council, and is liable to a fine not exceeding twenty pounds.

APPLE-PACKS FOR CANADIAN STANDARD CASE.

THE Canadian type of standard bushel case having been adopted under this season's Fruit-export Regulations, the following apple-packing specifications are printed for the guidance of packers —

Style of Pack (cross-wise).	Number in Rows (length-wise).	Number of Layers (Depth).	Size or Count.	Approximate Sizes.	Style of Pack (cross-wise).	Number in Rows (length-wise).	Number of Layers (Depth).	Size or Count.	Approximate Sizes.
2—1	4—4	3	36	4"	3—2	5—4	5	113	27
2—1	5—4	3	41	4"	3—2	5—5	5	125	29
2—2	3—3	4	48	3½"	3—2	6—5	5	138	29
2—2	4—3	4	56	3½"	3—2	6—6	5	150	28
2—2	4—4	4	64	3½"	3—2	7—6	5	163	28
2—2	5—4	4	72	3½"	3—2	7—7	5	175	27
2—2	5—5	4	80	3½"	3—3	5—5	6	180	27
2—2	6—5	4	88	3½"	3—3	6—5	6	198	27
3—2	4—3	5	88	3½"	3—3	6—6	6	216	28
2—2	6—6	4	96	3"	3—3	7—6	6	234	27
3—2	4—4	5	100	3"	3—3	7—7	6	252	27

a, for flat apples; b, for long apples; c, flat apples only; d, all apples.

—Horticulture Division.

COLLECTION OF AGRICULTURAL STATISTICS IN NEW ZEALAND.

THE method of collection of agricultural statistics in the Dominion is described by the Census and Statistics Office as under:—

The system used for the collection of the primary data exists in the police organization, the number of constables or other officers employed being over 270. Sub-enumerators are required to make personal visits to all holdings in their respective districts, except where a whole day or a considerable part thereof would be occupied in visiting a single holding: in this case a schedule may be posted to the farmer, and the information obtained in that way. When, on the visit of the sub-enumerator, the occupier is absent, a schedule may be left, and either called for later or posted to the sub-enumerator. Considerably fewer than 20 per cent. of the holdings are enumerated on schedules.

The complete service of statistical information on agricultural and pastoral matters made available through the Census and Statistics Office is briefly outlined as follows:—

In the spring (September) information regarding wheat, oats, and potatoes sown or intended to be sown in the season then commencing is obtained from all farmers who grew wheat, oats, or potatoes during the previous season. This information is published in the *New Zealand Gazette* about the end of October.

The carry-over of wheat and oats, as at the end of November, is ascertained by a postal inquiry from millers, merchants, and farmers. This information is also gazetted.

At the end of January estimated average yields per acre are obtained from Stock Inspectors of the Department of Agriculture, and on this basis an estimated total yield of wheat and oats is compiled and published in the *New Zealand Gazette* early in February. For potatoes no actual estimate is obtained, the yield per acre being assessed at the average for the five preceding seasons.

Commencing in February, a complete canvass of farmers is made by the police throughout the Dominion, and as soon as the collection has advanced to a reasonable stage some brief abstract of the information collected is published either in the *New Zealand Gazette* or in the "Monthly Abstract of Statistics," estimates being made for portions of districts outstanding. The final figures are published in the Annual Statistical Report on Agricultural and Pastoral Production.

In the case of potatoes and linseed, which are largely unharvested at the time of the sub-enumerator's visit, a system of post-harvest verification is employed.

As regards wheat and oats, the progress of the harvest can be followed by means of information collected from threshing-mill owners throughout the Dominion, results being published each month in the "Monthly Abstract of Statistics." The final figures obtained in this way are, however, always slightly below the total yields of wheat and oats disclosed by the personal canvass referred to above.

FORTHCOMING AGRICULTURAL SHOWS.

Marton A. and P. Association: Marton, 23rd February.
 Waipatu P. and I. Association: Ruatorea, 23rd February (Pastoral Show).
 North Kaipara Agricultural Association: Paparoa, 25th February.
 Franklin A. and P. Association: Pukekohe, 25th and 26th February.
 Waikato Central Agricultural Association: Cambridge, 2nd and 3rd March.
 Mongonui County A. and P. Association: Kaitiaia, 5th March.
 Opotiki A. and P. Association: Opotiki, 8th March.
 Morrinsville A., P., and H. Society: Morrinsville, 9th March.
 Amuri A. and P. Association: Waiau, 9th March.
 Taranaki Metropolitan Agricultural Society: New Plymouth, 9th March.
 King Country Central A. and P. Association: Te Kuiti, 10th March.
 Mayfield A. and P. Association: Mayfield, 19th March.
 Rotorua A. and P. Association: Rotorua, 23rd March.
 Methven A. and P. Association: Methven, 25th March.
 Temuka and Geraldine A. and P. Association: Geraldine, 31st March.
 Mackenzie County A. and P. Society: Fairlie, 18th April.

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THE GRASSLANDS OF NEW ZEALAND.

PROGRESS OF REGRASSING EXPERIMENTS ON DETERIORATED HILL COUNTRY IN WHANGAMOMONA COUNTY.*

E. BRUCE LEVY, Agrostologist, Biological Laboratory, Wellington.

I. INTERIM RESULTS OF BURNING AND SOWING TRIALS: SEED MIXTURES RECOMMENDED FOR SECONDARY BURNS.

CERTAIN of the experimental sowings in Whangamomona County are now drawing to the close of their third year, and during this period a considerable amount of intensive analytical work has been done, particularly in respect to the secondary burns. In the light of this work, coupled with a fair general knowledge of hill grasslands throughout New Zealand, some fairly definite information on the regrassing of the deteriorated country may now be offered.

The broad principles of the experimental work as they appeal to the writer are—

(1) The thorough testing of all grassland species, with a view to determining the most effective and economical seed mixtures to use on both primary and secondary burns.

(2) Economic studies into the controversial point of how best to tackle the problem of breaking in secondary-growth country.

(3) Intensive analytical studies of the successional development of the grassland sward under the varying soil types and differing farm-management.

(4) Comparative analytical studies in the building-up of soil-fertility, and responses by the vegetation to modifications of habitat brought about by this means.

(5) The determination of breaking-in and maintenance costs in the farming of this type of country, and the determination of what soil types or what secondary-growth types are economically sound to bring into permanent grassland.

* For details of the experimental sowings, locations, &c., for 1925 and 1926 see last month's *Journal*, pages 73 to 83.

The programme of work is only in its initial stages, but a good deal of information has already been gleaned, and it is thought expedient to publish this in the form of the present preliminary article.

Trials of Grasses and Clovers for Secondary Burns.

On this point we have done much work during the past three years in the Taranaki back-country. An aggregate area of 312 acres of secondary growth has been burnt and sown, and a great deal of careful analytical work carried out. The details here recorded of the analyses of the turfs secured as a result of the sowings are not a matter of guesswork. The tables are compiled from the examination of some 27,500 points of ground-surface sown. Each point has been examined carefully storey by storey, and each species covering the point of ground-surface examined is recorded.

The old guesswork days of computing results are gone. The science of grassland formation and development—as with all pure science—is wrapped up in exact knowledge. It is the truth of what happens that needs recording—not what one thinks is happening, nor yet what one would like to see and to feel ought to happen. The grassland farmer of New Zealand has wasted and is still wasting thousands of pounds sterling in the sowing-down of his grasslands, whether they be for hill country or for flatter dairying-land. Areas have been sown and ploughed, and sown and ploughed, and yet no record exists of just what grasses and clovers paid their keep in those mixtures sown, and which grasses and clovers did not do so. Again, an exact study of the succession will be a measure of the habitat, and a measure of the habitat is imperative to the formulation of farm practices that will govern the economical management of pastures. The point method of pasture-analysis makes this record largely possible.

In Table 1 are given the results of analyses of a sufficient number of the plots that have been sown to afford a very accurate idea of just how each of the species has done. In the fourth column are given the average number of times the species has been recorded for every 100 points of ground-surface examined. In the sixth column is set out the age of the plot in months when these analyses were taken. With certain species it will be seen that as the sowing gets older there is a decrease in the number of times this species is recorded—in other words, its cover has decreased. With others it will be seen that there is an increase in the number of times recorded, while in others again the figure is somewhat stationary. This decrease or increase of the species is of utmost importance. Upon it is based the construction of the mixture so as to afford as good a turf as possible right from the onset, and one that will rearrange itself and maintain a sward as the habitat changes. In other words, a knowledge of the decrease and increase enables succession to be accurately forecasted and provided for by the sowing of suitable grasses.

In the seventh column is given the theoretical cost, in shillings per acre, to cover the whole of the ground-surface sown with any one species, judged on its performance in the mixtures sown. Looking down this column it will be seen just where the cheap sward-formers are. Again, in some cases it will be noted that the cost per 100 points

is becoming greater as time goes on, while in others the cost per 100 points is becoming less. In others the cost is remaining fairly stationary. Where this cost is low per 100 points the species can be regarded as economical, but where the cost is high, and remains high indefinitely, then that species must be ruled out entirely. In the case of the cheaper species gradually getting more expensive, such species to be economically sound must pay their way in the first few years, providing feed during this period while other slow-establishers are getting going. In the case of the expensively establishing species that are gradually becoming cheaper, time alone will prove whether or not their inclusion in the mixture is sound. One feels from field experience in other parts of New Zealand that certain of the slower-establishing species will prove economical and will justify their inclusion.

Table 1.—Showing the Relative Positions of the Main Grassland Species sown on Secondary-growth Burns up to the End of the Third Year of their Trial.

Species.	Amount of Seed sown per Acre.	Cost of Seed sown per Acre.	Average Number of Times recorded per 100 Points examined.	Total Number of Points examined.	Age of Turf when analysed.	Cost per 100 Points of Cover.
	lb.	s. d.			Months	s.
Prown top	4	14 0	35	2,500	12-34	40
	2	7 0	35	6,000	9	20
	2	7 0	25	5,000	12-23	28
	2	7 0	39	2,000	32-34	18
	1	4 6	29	2,000	18-34	12
	1	0 10½	9	5,500	15-23	9
	1	0 10½	17	4,500	32-34	5
Crested dogtail	4	5 0	21	6,000	9	24
	4	5 0	14	10,000	12-23	36
	4	5 0	11	6,000	32-34	45
	6	7 6	13	4,000	18-34	58
	2	2 6	18	1,000	15	14
Cocksfoot	8	10 0	5	7,500	12-23	200
	8	10 0	2	7,000	32-34	500
	6	7 6	2	1,000	9	375
	4	5 0	2	2,000	9-15	250
	3	3 9	1	2,000	9-12	375
	2	2 6	1	1,000	0-12	250
	0		2	7 000	9-33	(volunteer).
Perennial rye-grass	6	2 6	6	6,500	12-23	42
	6	2 6	3	6,500	30-34	83
	1	1 8	7	3,500	12-18	24
	4	1 8	3	3,000	30-34	55
	2	0 10	3	6,000	9	28
	0		0.3	2,000	12	(volunteer)
White clover	2	4 0	12	500	18	33
	2	4 0	3	1,000	30-34	133
	1	2 0	8	6,000	14-23	25
	1	2 0	7	6,500	32-34	29
	1	1 0	4	6,000	9	25
	1	1 0	8	3,500	12-23	13
	1	1 0	6	2,000	32-34	17
	1	0 6	5	1,000	15	10
Lotus major	1	4 0	3	1,000	12-18	133
	1	1 0	21	1,000	30-34	19
	1	2 0	0.5	6,000	9	500
	2	2 0	3	10,000	12-23	66
	2	2 0	19	8,500	30-34	11
	1	1 0	1.5	1,000	15	66
Lotus hispidus ..	1	1 6	3	1,000	18-30	50
	0	0 9	1	6,000	9	75
	0	0 9	2	10,500	12-23	75
	0	0 9	1	9,000	32-34	75
	0	0 4½	1	1,000	15	38

Table 1—continued.

Species.	Amount of Seed sown per Acre.	Cost of Seed sown per Acre.	Average Number of Times recorded per 100 Points examined.	Total Number of Points examined.	Age of Turf when analysed.	Cost per 100 Points of Cover.
	lb.	s. d.			Months.	s.
Danthonia pilosa ..	8	20 0	3	3,000	14-23	666
	8	20 0	14	4,000	32-34	143
	4	10 0	2	1,000	9	500
	4	10 0	11	500	33	91
	3	7 6	4	3,500	9-18	190
	3	7 6	11	1,000	33	70
	2	5 0	0.5	1,000	9	1,000
	1	2 6	3	6,500	9-23	83
	1	2 6	4	4,000	33-34	62
	1	1 3	0.6	1,000	9	210
	0	..	2	2,500	9-12	(volunteer).
Paspalum ..	8	12 0	2	2,000	12-18	600
	8	12 0	10	2,000	32-34	120
	4	6 0	0.1	1,000	9	6,000
	3	4 6	0.1	1,000	9	4,500
	2	3 0	0.1	1,000	9	3,000
	2	3 0	0.7	4,500	12-33	430
	2	3 0	3	7,500	32-34	100
	1	1 6	0.2	5,500	9-15	75
Chewings fescue..	4	5 0	13	500	32	38
	2	2 6	3	500	12	83
	1	1 3	1	1,500	32-34	125
	1	1 3	1.5	1,000	12-23	83
	1	0 7½	1	7,500	12-23	63
	1	0 7½	1	6,600	32-34	63
Subterranean clover ..	1 oz.	4 0	3	1,500	18-34	133
	1 oz.	2 0	0.5	7,500	12-23	400
	1 oz.	2 0	1	8,500	32-34	200
	1 oz.	1 0	0.4	6,000	9	250
	2 oz.	0 6	0.3	3,500	12-15	166
Poa pratensis ..	1	1 9	3	1,000	14-18	58
	1	1 9	2	1,500	32-34	87
	1	0 10	0.5	6,500	14-23	175
	1	0 10	3	6,500	23-34	29
	1	0 5½	2	1,000	14-15	22
	0	..	2	6,000	9-34	(volunteer).
Yarrow ..	1 oz.	0 3	1	8,500	9-12	25
	1 oz.	0 1½	1	9,000	14-23	17
	1 oz.	0 1½	1	9,500	30-34	13
Yorkshire fog (volunteer)	..	..	4	9,000	9-12	..
	..	..	9	9,000	12-23	..
	..	..	7	9,500	30-34	..
Suckling-clover (volunteer)	..	..	6	9,000	9-12	..
	..	..	4	9,000	14-23	..
	..	..	11	9,500	30-34	..
Sweet vernal (volunteer) ..	..	..	1	9,000	9-12	..
	..	..	1	9,000	14-23	..
	..	..	1	9,500	30-34	..

As far as the cost of 100-point cover is concerned, it will be noted that almost without exception the less seed applied the cheaper is such cover. In the case of brown-top, for example, where only $\frac{1}{4}$ lb. was included in the mixture, after three years 100-point cover costs only 5s. per acre, whereas where 2 lb. per acre was sown the cover costs 18s., and the 4 lb. seeding 40s. over the same period. This brings up an extremely important point in the formulation of grassland mixtures, particularly so for the permanent-grassland-soil type we are here considering. Apart from the early cover a quickly establishing species gives, there does seem a very important principle embodied in what may be termed the habitat spread. One seed alighting in a suitable

habitat may produce in time 100 per cent. cover to the limits of that habitat, whereas 1,000 seeds alighting on an unsuitable habitat may never establish at all, or if they do so their spread is virtually nil. Brown-top, white clover, and Lotus major are cases in point. If the habitat is suitable for the spread of these species very few plants indeed established per acre will in the course of time completely cover the ground; whereas if the habitat be unsuitable the writer firmly believes that no quantity of seed, however great, will ever form a turf of these species in such situations.

Modification of the habitat through top-dressing, spelling, &c., may influence considerably the spread of any one species, by the increase of the actual area of the habitat suitable for that species, and wherever practicable all pasture-management should be directed towards a setting-up of correct conditions, so that spread of the desirable species is made possible. Rye-grass or white clover will not spread on a danthonia habitat, neither will danthonia spread on a rye-grass or white-clover habitat.

Besides the species mentioned in Table 1, some sixty-odd additional species were included in the experimental sowings, but on these plots observational work only has been done. Without exception, however, it may be said that at the present time none of the species not included in the table is showing any promise whatever of being more successful than such species as brown-top, crested dogstail, Lotus major, Danthonia pilosa, paspalum, white clover, and rye-grass. It may be too soon, of course, for certain slowly establishing species to have made much headway, and it may be some years yet before definite information is obtained. In the meantime, however, farmers must rely on those species that are giving promise of success and the seed of which can be bought.

Conclusions regarding the Main Species Included in the Experimental Sowings.

The records and performances of each species as set out in Table 1 are true for good average conditions throughout Whangamomona County. From a close study of these figures one may draw some very pertinent conclusions regarding each species in so far as the experiments have gone. It is found that the species can be classified into four definite groups, as follows:—

(1) Those species that are cheap to establish from seed sown, but which persist for a short time only, their disappearance being due almost entirely to the rapid exhaustion of plant-food represented by the ash of the burn. Persistence and spread of these species are possible only under constant manuring. Types: Perennial rye-grass and white clover.

(2) Those species that are cheap and rapid to establish from seed sown, and which persist for a considerable time, gradually weakening unless fertility is kept up somewhat by manurial top-dressing. Types: Crested dogstail and brown-top.

(3) Those species slow to establish and slow to spread from seed sown, but which ultimately form a cheap sward owing to their ability to spread both vegetatively and from seed shed. Types: Danthonia pilosa, Lotus major, and paspalum.

(4) Those species which up to the present are expensive to establish from seed sown, and which show little or no indications at present of ever becoming cheaper. Types: Cocksfoot, *Poa pratensis*, *Lotus hispidus*, and subterranean clover.

PERENNIAL RYE-GRASS.

Perennial rye-grass (*Lolium perenne*) is a very rapid establisher, and while there remains a certain amount of ash throws quite a fair amount of feed. The analyses show a comparatively cheap cover for the first year, being in this respect about equal to crested dogstail. To get, however, as high a cover figure as is shown by crested dogstail—21 points for the first nine months—about 15 lb. of seed of rye-grass would have to be included in the mixture sown. Both brown-top and crested dogstail are somewhat slower than rye-grass to establish and get going, and in view of the fact that the per-100-point cover is comparatively cheap, for the first year at least, the writer considers that perennial rye-grass should always be included in the mixtures, even though the cover is but of a temporary nature.

With regard to our Whangamomona sowings, the writer is inclined to think that a mistake has been made in keeping the rye-grass so low, particularly in the two latter years. From 6 lb. to 8 lb. per acre should be included in mixtures sown. The lasting-qualities of rye-grass on the average-quality secondary-growth-burn conditions are seen in the table. In three years it has declined to under half its original cover, and the theoretical 100-point-cover cost per acre has greatly increased. Where no rye-grass was sown a small volunteer cover is recorded.

WHITE CLOVER.

White clover (*Trifolium repens*) has proved one of the cheapest covers. For the first year it compares very favourably with any other species, and under top-dressing is likely to maintain itself well. Under strong competition with *Lotus major*, however, it seems to have fared very badly in certain plots during the third year (Fig. 3). In this investigation not only must one study the behaviour of the individual as a separate entity, but also its relation to the other species sown in the mixture. There is no doubt that for the first two years white clover has easily outclassed any other clover sown, although it must be admitted that frequently the volunteer growth of suckling-clover often covers more ground than does the white clover—and this at no cost to the farmer, the ground for the most part being well supplied with seed of this species. White clover when not top-dressed declines badly in the third year. In one plot at eighteen months white clover was standing at 12 points, and at the end of the third year these same sowings recorded only 3 points. On the other hand, the top-dressed plots have maintained a very cheap cover for the amount of seed sown.

The writer is not quite sure whether $\frac{1}{2}$ lb. of white-clover seed per acre is enough. In the 1924 sowings 1 lb. was included in the mixtures for most plots, and one is inclined to think that this amount is preferable to $\frac{1}{2}$ lb. per acre. Much, of course, depends on the habitat, and whether top-dressing can be carried on. If the soil is very fertile and there is not a great deal of competition $\frac{1}{2}$ lb. of seed per acre would

soon cover, but where conditions are not so good, yet good enough for white clover to thrive moderately well, more plants per acre seem desirable to secure, for the spread under these conditions is not so great. The analyses, however, show very little difference in per-cent. cover between the $\frac{1}{2}$ lb. and the 1 lb. per-acre sowings, although certainly the cover from the $\frac{1}{2}$ lb. seedings for the first year is low.

The point is that white clover under fair treatment forms a cheap cover, and every effort should be made to get the optimum establishment right from the start. It is necessary to emphasize, however, on the failure of white clover under hard and infertile conditions, no matter how much seed is sown, New-Zealand-grown white-clover seed should always be sown in preference to ordinary imported white clover.

CRESTED DOGSTAIL.

Crested dogstail (*Cynosurus cristatus*) has proved to be a very good establisher on secondary burns, but the cover formed from this species is a trifle dearer than in the case of brown-top. Theoretically, 25s. per acre spent in crested dogstail would entirely cover the ground. There is, however, in crested dogstail a significant decrease to the end of the third year. The cover has declined from 21 points in the first year to 11 points in the third year, and the theoretical cost per 100 points of cover has increased from 24s. up to 45s. per acre.

However, even if crested dogstail still declines, it has earned for itself a place in all secondary-burn sowings, tiding over well that period between the going-out of the rye-grass and the coming-in of the slower establishers such as danthonia, paspalum, and Lotus major (Fig. 1). As in the case of brown-top (see later), the heavier sowings show no advantage over the 4-lb.-per-acre seedings. The 2 lb. sowings did exceptionally well, forming a cheaper per-100-point cover, and for the first fifteen months almost equalled the 4 lb. seedings. However, an insufficient number of plots containing this amount of seed were sown to enable very much trust to be placed on this figure. From 3 lb. to 4 lb. of crested-dogstail seed should be included in all secondary-burn mixtures.

BROWN-TOP.

Of all species included in these trials brown-top (*Agrostis tenuis*) has formed the best and cheapest cover. By the expenditure of from 6s. to 7s. per acre on brown-top seed one can rely, excepting on the very hardest knolls (Fig. 5), on covering approximately one-third of the entire surface sown. Theoretically, all the ground could be covered with this grass at a little over 20s. per acre. Analyses after three years show the position for brown-top to be still very sound, the cover per 100 points of vegetation becoming somewhat cheaper than in the first year (Fig. 2).

During the second year, as will be seen from Table 1, there was a slight falling-off in the percentage cover, which may be explained somewhat on the fact that the analyses for this period were spread throughout the whole year, while those of the third year were mostly done last December when everything was showing at its best. The cheapness per 100 points of the lighter seedings has already been referred to. Here, as far as ground covered is concerned, the $\frac{1}{2}$ lb.

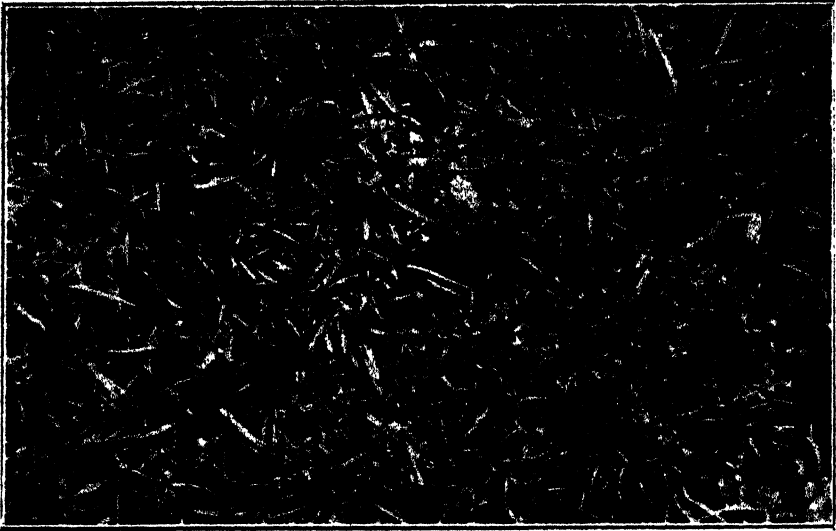


FIG. 1. SWARD FORMED ON SECONDARY BURN AFTER TWENTY-ONE MONTHS (MIXTURE NO. 3, 1925 SOWINGS).

Crested dogtail and brown-top dominant, with *Lotus major* throughout just beginning to make itself felt in the mixture. Plot top-dressed in winter of 1926, fifteen months after burning and sowing. The dogtail and brown-top are here following on well after early but more or less temporary rye-grass growth.



FIG. 2. SWARD FORMED ON SECONDARY BURN AFTER THREE YEARS (MIXTURE NO. 7, 1924 SOWINGS).

Showing complete cover with brown-top and *Lotus major* dominant. Plot top-dressed in 1925 and 1926.

[Photos by E. Bruce Levy.]

sowings in the second year effected approximately a quarter of the cover of the 2 lb. seedings, and in the third year there has been a marked increase. During the first year, however, the turfs formed by the $\frac{1}{2}$ lb. sowings were very weak, and even 9 points in the second year cannot be regarded as a satisfactory cover for this grass. Little gain seems to accrue from the heavier seedings on the average, although individual plots did show to an advantage over the 2 lb. seedings. For general purposes for all secondary burns 2 lb. per acre of brown-top should be included in the mixture.

LOTUS MAJOR.

Lotus major, in contradistinction to white clover, is very slow to establish, and the cover formed for the first two years is very expensive. For the first year practically no feed at all is given by this plant. In the second year it is contributing some 3 points per 100 examined, and in the third year the cover averages out in the neighbourhood of 20 points per 100. In some cases individual plots have averaged over 50 points, while several other plots come within the 30 to 40 points per 100 group (Fig. 3). In these latter plots the cost of the cover works out extremely cheaply in the third year per 100-point cover. In the first year certain plots cost approximately £25 per 100-point cover, but after the third year this cover is in the neighbourhood of a few shillings.

Lotus major seems very amenable to treatment, and hence is very susceptible to variation under the different conditions ruling. Close and continuous grazing, as against intermittent grazing and spelling, has a big influence on the development of the plant. On one area under close and continuous grazing for nearly three years *Lotus major* now covers 7 points, and this series has been top-dressed twice with basic slag, 3 cwt. per acre at each dressing. On the other hand, areas that have not been so closely grazed record an average of 40 points per 100. Certain plots of this series were top-dressed once, and other plots twice. Where no top-dressing has been carried out, but intermittent grazing and spelling practised, *Lotus major* there shows in its third year 14 points per 100.

Lotus major certainly does look like one of the most promising species for the class of hill country we are dealing with in Taranaki (Fig. 4). Its rapid increase during the third year speaks well for its future, and with reasonable handling of the country once this clover is well established it bids fair to remain there and do good work for all time. As far as the quantities per acre are concerned, the $\frac{1}{2}$ lb. sowing per acre would seem to be sufficient. *Lotus major* is one of those species that, owing to the slowness of their establishment, must come on later from small quantities of seed sown, spreading out either vegetatively or by reseeding. Unless a slow-establishing plant can do this it must be eliminated from the mixture sown. An amount of $\frac{1}{2}$ lb. of *Lotus major* per acre should be included in all secondary-growth mixtures where the annual rainfall is over 60 in.

DANTHONIA PILOSA.

Danthonia pilosa is extremely slow to establish, and the cover that this species gives for the first three years is most expensive. To cover the whole ground-surface in the first year, theoretically, would take

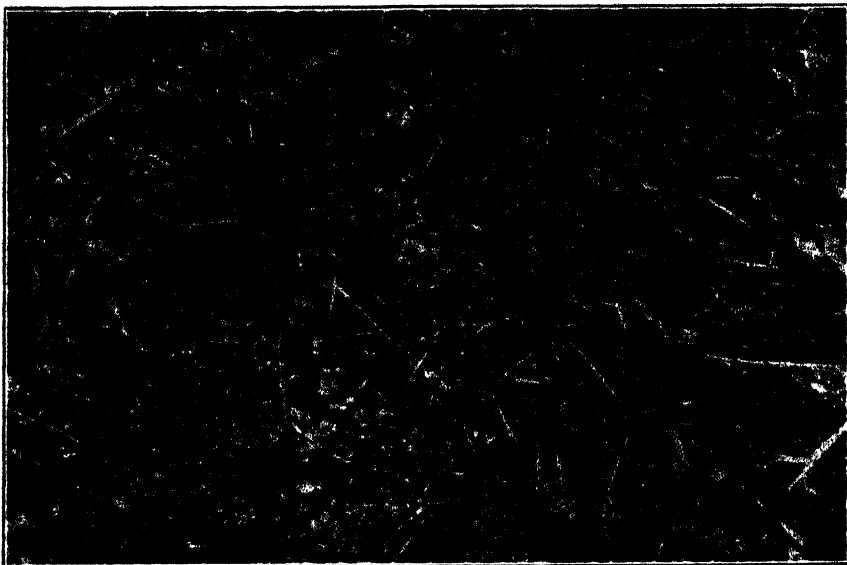


FIG. 3. LOTUS MAJOR AND BROWN-TOP DOMINANT ON THREE-YEAR-OLD SOWING ON SECONDARY BRACKEN BURN; TOP-DRESSED 1925 AND 1926.

Lotus major is here contributing well over 50 points, and dense growth formed has almost entirely eliminated white clover from this plot. Heavier stocking to control Lotus major somewhat, so that white clover may be able to persist, is desirable.



FIG. 4. LOTUS MAJOR AND BROWN-TOP, DOMINANT AFTER THREE YEARS, PENETRATING WELL INTO SMALL PATCH OF STUNTED BRACKEN THAT CAME AWAY AFTER BURN.

With a pasture growth of this nature thriving on the area the elimination of the bracken is easily accomplished. Plot top-dressed twice.

[Photos by E. Bruce Levy.]

from £25 to £50 an acre for this seed. In the second year the cover is very little cheaper, but in the third year there is a considerable reduction in the cost. *Danthonia* comes within the same group as *Lotus major*, and, like that species, very little reliance can be placed on it as a producer for the first three years at least. *Danthonia* typifies very well the folly of including large quantities of seed of these slow-establishing species in the hope of getting an immediate cover. The policy with *danthonia* should be to include some 2 lb. to 3 lb. per acre in the mixture and then wait the necessary time for natural increase brought about by vegetative tillering and seed shed.

In the sowings of 1924 we were unfortunate in securing a rather low germinating line – about 40 per cent. In 1925 and 1926 the *danthonia*-seed used was of good quality, germinating in the vicinity of 80 per cent. Farmers should take every precaution in the buying of this seed, for generally there are many poor lines on the market. It was of great interest to note that on burns adjacent to old-established *danthonia* seedling *danthonia*-plants made their appearance without more seed being sown, and in the second year of the sowings young plants of *danthonia* could be found firmly established from seed shed the previous autumn by the one-year-old *danthonia*-plants (Fig. 7). This re-establishment under hard surface conditions from seed shed must be regarded as one of the most hopeful signs for the ultimate success of this species and for the betterment of that country as a whole.

There is no grass, in the writer's opinion, that can just fill the place of *danthonia* (Figs. 5 and 6), and to ensure its presence is to provide the best insurance policy against deterioration that the farmer could obtain. Where there is some *danthonia* already established on the country that is being burnt and sown the need to include the seed of this species is not nearly so urgent, but where little or none can be found some seed should certainly be included in the mixture. From 2 lb. to 3 lb. per acre of good seed should be sown.

PASPALUM.

Paspalum (*Paspalum dilatatum*) has proved even more expensive than *danthonia* to establish and to form a cover for the first three years. A glance at the table will show the extremely low point cover and the extremely high cost per 100 points, although at the end of the third year there has been quite a noteworthy increase in the cover in certain of the plots (Fig. 8). The behaviour of *paspalum*, in fact, coincides closely with that of *danthonia*. Neither are of much use for the first three years.

The establishment of *paspalum* in the Taranaki back-country is extremely fickle. On the sunny aspects this grass has established well, and as high as 22 points per 100 have been recorded in the third year on one area where the plots were situated on a sunny aspect and where the soil-fertility was moderately high. On the southerly faces, however, the average of points per 100 works out at a little over 1 point after three years, and in these cases 8 lb. of *paspalum*-seed per acre was included in the mixture. The hope for *paspalum* on these shady and colder aspects is not great. In districts farther north and

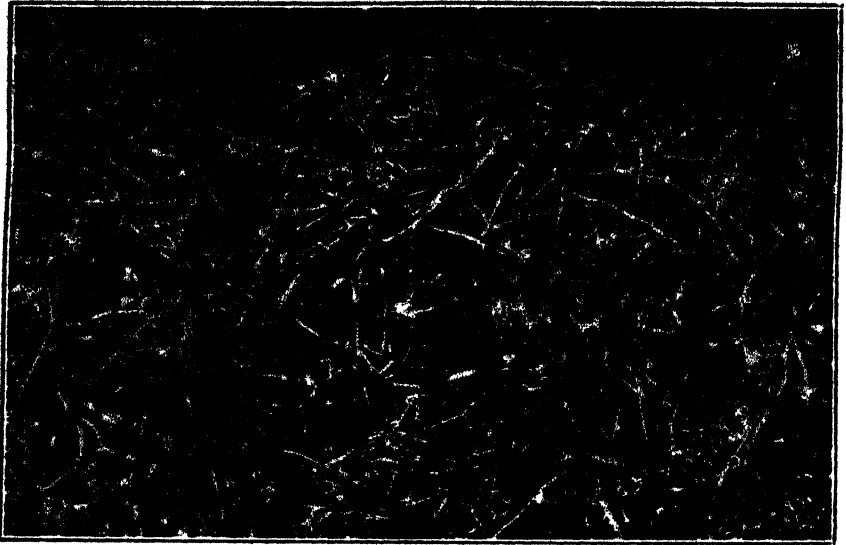


FIG. 5. HARD KNOLL ON TWO-YEAR-OLD HARD-FERN SECONDARY BURN SOWN IN 1925 (MIXTURE NO. 3), SHOWING POOR GROWTH AND VIRTUALLY NO SPREAD FROM BROWN-TOP, CRESTED DOGSTAIL, LOTUS MAJOR, ETC.

This aspect is essentially the danthonia habitat, and the writer knows no plant that will satisfactorily grass such a spot excepting *Danthonia pilosa*. Cost of altering appreciably such a habitat by manuring would be in the vicinity of £3

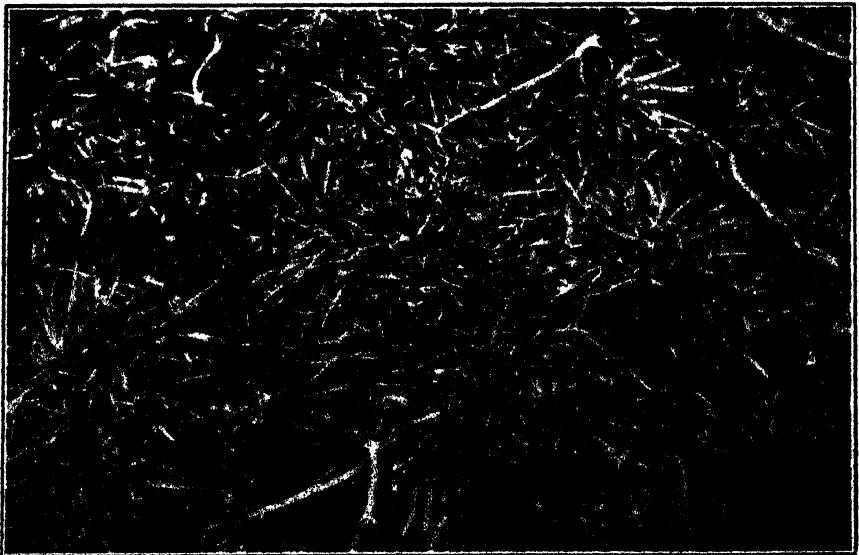


FIG. 6. *DANTHONIA PILOSA* WELL ESTABLISHED AND TILLERING OUT SPLENDIDLY ON A HABITAT EXACTLY SIMILAR TO THAT SHOWN IN FIG. 5.

Mixture sown here (No. 4, 1925 sowing) contained 3 lb. danthonia (germination 80 per cent.), otherwise mixture identical to that sown and illustrated in Fig. 5.

[Photos by E. Bruce Levy.]

warmer than Whangamomona paspalum should show up much better, and in such places, and also on the warmer sunny faces throughout the Taranaki back-country, about 2 lb. of paspalum-seed per acre should be included in the mixture.

CHEWINGS FESCUE.

Chewings fescue (*Festuca rubra* var. *fallax*) is fairly rapid to establish, and the seed being fairly cheap makes the use of this grass enticing. It does not compare with brown-top, however, as an early establisher, and as a permanent grass it does not compare favourably with *Danthonia pilosa*. In certain of the very hard sandstone faces that are too poor for brown-top the inclusion of Chewings fescue in the mixture may be warranted. Its showing in the plots certainly compares more favourably at the present time than either paspalum or danthonia, and perhaps it is still a little early to condemn this grass as far as the Taranaki back-country is concerned. One thing seems fairly definite: a small quantity of seed in the mixture is of little value, as the spread of any one plant is slow, and when it comes to the inclusion of larger amounts—say, 4 lb. to 6 lb. per acre—it is just doubtful whether that money would not be better spent on certain other species. Certainly one should not include Chewings fescue to the exclusion of either brown-top or danthonia.

COCKSFOOT.

Cocksfoot (*Dactylis glomerata*) has proved to be almost a complete failure on secondary burns. It is just about ten times as expensive to establish and to form a cover as brown-top or crested dogtail, and to the end of the third year shows no improvement, but rather a decline. In the first year, theoretically, it would cost £10 an acre to cover all the ground with cocksfoot, and at the end of the third year this cover cost has increased to £25 per acre. Compare this with the £1 an acre in the case of brown-top, or even with the £2 5s. per acre cover of crested dogtail, after the three years.

It will be noted that after three years cocksfoot is recorded as 2 points per 100 points examined, and in these plots 8 lb. (or 10s. worth) of seed per acre was included in the mixtures. One may refer now to the plots analysed, sown at the same time, but where no cocksfoot-seed was included in the mixture. Here we record also 2 points of cocksfoot per 100 points examined. The significance of this calls for some comment. The cocksfoot showing where none had been sown is the vestiges of old cocksfoot-plants that have withstood the burning, or which came up as volunteers from seed shed from old-established plants persisting in the secondary growth before burning. It appears to the writer as though this percentage cover represents approximately the per-cent. cocksfoot habitat, and if this is so it matters not how much seed is sown; unless the habitat is modified, sooner or later cocksfoot will readjust itself to this 2-per-cent. cover, that being a measure of the 2-per-cent. cocksfoot habitat.

The writer has frequently stressed this habitat influence on the different grassland species, and the more the question is studied the more and more is he convinced that each grassland species has a definite habitat or set of conditions that must be provided before that particular species

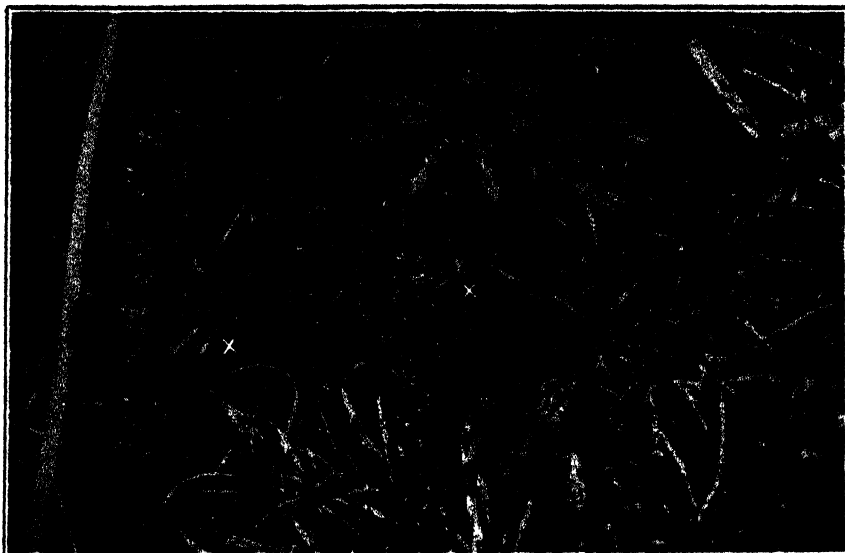


FIG. 7. HARD FACE ON A TWO-YEAR-OLD SECONDARY BURN WHERE MOST OF THE GRASSES SOWN HAVE FAILED TO TAKE.

The two small plants marked \times are seedling *Danthonia pilosa* successfully established from seed shed by one-year-old danthonia-plants grown from seed sown in 1925 (mixture No. 4). Importance of such re-establishment cannot be overestimated.

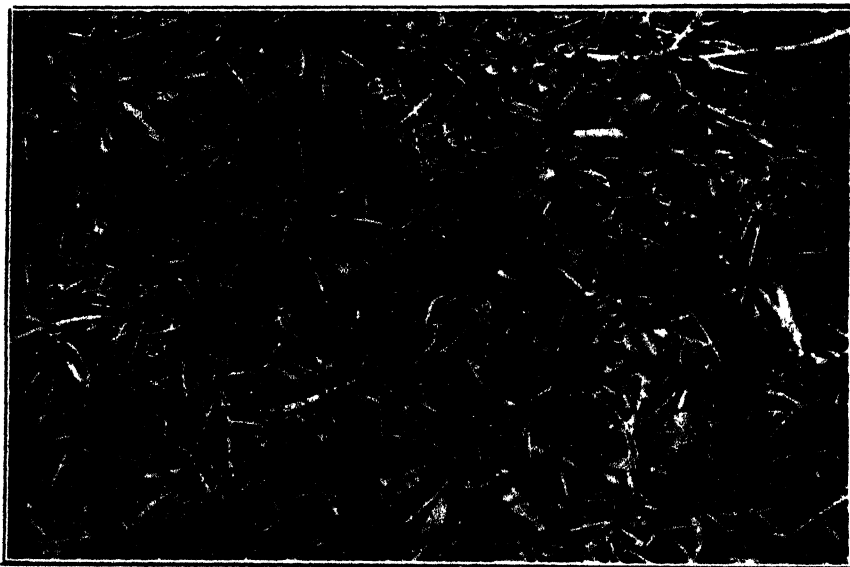


FIG. 8. THREE-YEAR-OLD SWARD FORMED BY SOWING ON SECONDARY BURN.

Brown-top dominant, with fair sprinkling of *Lotus major* and crested dog-tail throughout. The broad-leaved grass towards right of photo is *paspalum*; 2 lb. was included in mixture, and on this area at thirty-one months 4 points per 100 of *paspalum* were recorded. Plot top-dressed 1925 and 1926.

[Photos by F. Bruce Levy.]

will thrive. The economics of this consideration must be apparent to all, and the task of measuring grassland habitats so as to avoid waste in seeding becomes more and more pressing. The records given for cocksfoot under the average conditions of Whangamomona County show very clearly indeed that unless the farmer can considerably modify the soil-conditions of his hillsides by constant top-dressing and by careful manipulation of his stock it is quite useless to include any cocksfoot in the secondary burns sown. In fairness to cocksfoot it must be added that the seed used for the first two years was Danish. Last year Akaroa seed was largely used, but analyses so far show no noticeable improvement.

POA PRATENSIS.

Poa pratensis is a grass that seems to require fairly fertile conditions to establish satisfactorily from seed. When sown on the primary burn one gets fairly good establishment, and such plants will persist almost indefinitely—but as mere vestiges wherever conditions remain hard. Throughout the secondary-growth country there is a small amount of *Poa pratensis* persisting. When, however, it comes to the question of including more seed in the secondary-burn mixture very little hope can be held out for much additional establishment of this grass. In the records for *Poa pratensis* in Table 1 it will be noted that its volunteer growth (no seed of *Poa pratensis* being included in some mixtures) is equal in amount to that of those plots where upwards of 1 lb. of seed per acre was sown. Here, then, one has a parallel case to cocksfoot where habitat conditions permit only a certain per-cent. cover; and here again the writer fully believes that if 20 lb. or more of *Poa-pratensis* seed per acre had been sown not more than the 3 point per 100 points of cover would have resulted. For secondary burns, therefore, the inclusion of *Poa pratensis* in the mixture is not advised.

LOTUS HISPIDUS.

Lotus hispidus has failed almost completely to do much good up to the present. Although the seed of this clover is much cheaper per pound than that of *Lotus major*, the cover formed is very much dearer in the third year. In their efforts to get *Lotus major* established many farmers sowing secondary-growth burns prefer to sow the mixed *Lotus hispidus* and *Lotus major* seed because of the much lower price asked for this mixture than for the *Lotus major* pure. It will be seen from the performances of these two species that after three years sown the *Lotus major*, on the average, is about four times as cheap as *Lotus hispidus*.

The writer feels certain that by these comparative analyses of turfs we shall all learn to judge any seed we include in mixtures not by its price per pound of seed, but by its performance in the field after a number of years' trial. There are many species and strains of various seeds on the market, varying greatly in price, and at the present time it must be admitted that one does not know whether Hawke's Bay rye-grass at 14s. a bushel is dearer or cheaper than, say, Southern rye-grass at 8s. a bushel. It is only after careful analytical work over a period of years and on all grassland habitats that the most economical sowings can be prescribed.

Lotus hispidus may, of course, yet improve its position in the sowings made, but until this improvement is manifest its inclusion in mixtures cannot be recommended for the back Taranaki class of country.

SUBTERRANEAN CLOVER.

When starting out on this work we certainly had hopes of subterranean clover (*Trifolium subterraneum*). From seed the plant is extremely rapid to establish, and the early spring growth is most acceptable; but, unfortunately, the early promise of this clover has not been entirely fulfilled. A glance at the table shows an extremely expensive cover for the three years the plots have been in progress. Certainly for the third year there does seem to be a slight improvement

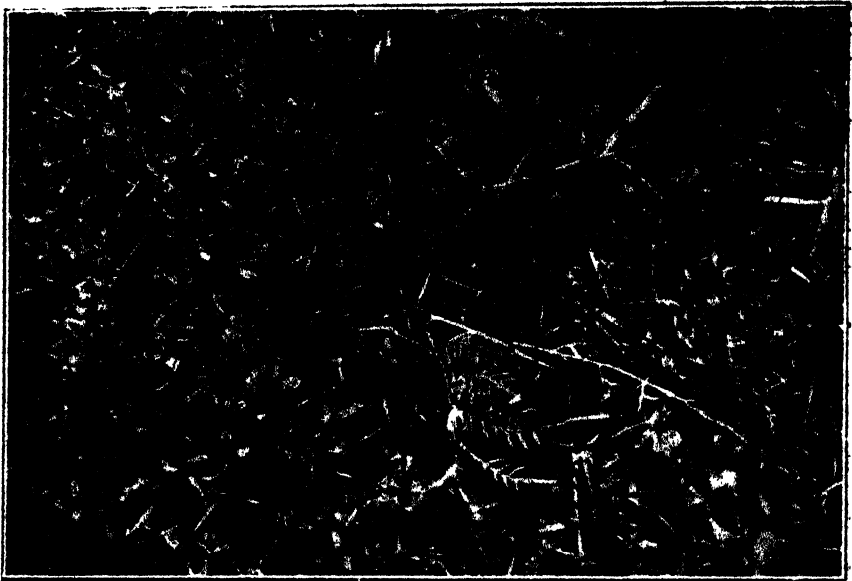


FIG. 9. SUBTERRANEAN CLOVER (LOWER LEFT OF PHOTO) PERSISTING SOMEWHAT STRONGLY ON THREE-YEAR-OLD SECONDARY BURN THAT HAS BEEN TWICE TOP-DRESSED.

This area was rotationally grazed and every chance given for subterranean clover to develop. Analyses when photo taken at thirty-one months show subterranean clover contributing 4 points per 100; 1 lb. of the seed was included in mixture.

[Photo by E. Bruce Levy.]

(Fig. 9), but when this is compared to the cover formed by *Lotus major* or white clover one must say definitely that subterranean clover is a very expensive species for the first three years at least. It is, however, too early yet to condemn this clover. A comparatively small quantity of seed only has been used, and the seed is very large in comparison to white clover and *Lotus major*. Birds, also, are destructive of the seedlings, so that taken all in all very few plants per acre became established, and spread from these may be a matter of some years.

Subterranean clover, then, comes into the third class of pasture species, and its economic use is along the lines of including a very small amount in the mixture and waiting for its increase by voluntary reseeding. If the increase does not come after a certain number of years, then subterranean clover must be deleted from our list of useful species. Farmers desiring to give this clover a trial would be wise to include not more than $\frac{1}{4}$ lb. of seed per acre, and on no consideration should preference be given to it before white clover or *Lotus major*.

YARROW.

Yarrow (*Achillea millefolium*) was included in almost all our mixtures, but in very small quantities. From this few pence worth of seed, however, as many points of vegetation have been secured as from the many shillings spent in the case of subterranean clover. On a theoretical basis per 100 points of vegetation yarrow is very cheap to establish, but whether the plant is of much use once it is established is a debatable point. However, one must be prepared to welcome anything in the form of a cheap feed for much of the country being dealt with. The small quantity that we have been using, however, is hardly giving this plant a fair test. It would appear that more seed should be used or the species deleted from the mixture altogether. In our pure sowings in 1926 5 lb. per acre was sown, and when these plots have been going a few years one will be in a better position to know what should be done in regard to this species.

SUCKLING-CLOVER.

Suckling-clover (*Trifolium dubium*) has not been sown on any of the plots. This is not because we do not appreciate its importance, but because the plant is natural to the country, and a big volunteer growth (equivalent to the take one might expect to get from the sowing of many pounds of the seed per acre) is general over most of the areas burnt. Were it not for this volunteer growth one would certainly advise the inclusion of this clover in the mixture. Over many of the plots that have been top-dressed perhaps the greatest response of any species is made by suckling-clover, and in the initial manurial top-dressing of old worn-out turfs it is the response of this clover that largely justifies the expenditure on the top-dressing for the first year or so, until the white clover is sufficiently strengthened to carry on.

YORKSHIRE FOG.

Yorkshire fog (*Holcus lanatus*) has not been sown as a regular constituent of the mixtures, but quite a large volunteer growth has made its appearance from seed lying dormant within the secondary growth. The average figures given in Table 1 for the three years are really very significant and represent a cover not to be despised, particularly when the cover is secured for nothing. Whether or not this cover could be increased by the sowing of more seed is a moot point, and one feels that when it comes to paying for a Yorkshire-fog cover one is more inclined to put that money into the seed of some other species that has a better feeding-quality. Whether this course is sound, however, the writer would not like to say at present.

SWEET VERNAL.

Sweet vernal (*Anthoxanthum odoratum*) is general over most of the country as a volunteer, but, as will be seen from the analyses, the average percentage cover is low—much lower really than what one would expect. On the poorer and harder country, particularly that which is quite run out, there is often a very marked volunteer growth of sweet vernal. On Mr. A. Bottomley's farm at Whangamomona, for example, the volunteer growth for the second year was 17 points, and 15 points in the third year. On this place the take of the regular grasses sown was extremely bad, and the writer is very much inclined to the opinion that a large sweet-vernal volunteer growth, particularly when the growth is sparse and the plants stunted, is a fairly certain indication that the fertility is very low and that it is useless to expect much else than danthonia to do well on that country. This, however, does not at all hold true where the sweet vernal is growing vigorously.

These volunteer growths, as pointed out elsewhere in this article, are extremely valuable, and the ultimate economic control of secondary growth is largely wrapped up in establishing additional species that will return as volunteers on the burning-off or on the crushing-out of that country, as often as it is necessary to finally kill the secondary growth outright.

Seed Mixtures for Secondary Burns.

The following mixtures, based on present-day knowledge, are recommended for secondary-growth country:—

- (1) *Good general secondary-burn mixture for all hill country having over 60 in. rainfall.* (2) *Secondary-burn mixture for hill country having over 60 in. rainfall where efficiency of mixture is slightly sacrificed to reduce cost*

	lb		lb.
Brown-top	2	Brown-top	2
Crested dogtail	4	Crested dogtail	3
Perennial rye-grass	6	Perennial rye-grass	6
White clover	1	White clover	$\frac{1}{2}$
Lotus major	$\frac{1}{2}$	Lotus major	$\frac{1}{2}$
Danthonia pilosa	3	Danthonia pilosa	2
Total per acre	16 $\frac{1}{2}$	Total per acre	14
Cost per acre approximately 26s.		Cost per acre approximately 20s.	

- (3) *Secondary-burn mixture where likelihood of paspalum proving a success.* (4) *Secondary-burn mixture where rainfall is below 60 in*

	lb		lb.
Brown-top	2	Brown-top	1
Crested dogtail	3	Crested dogtail	4
Perennial rye-grass	6	Perennial rye-grass	6
White clover	$\frac{1}{2}$	White clover	1
Lotus major	$\frac{1}{2}$	Danthonia pilosa	4
Danthonia pilosa	2		
Paspalum	2	Total per acre	16
Total per acre	16	Cost per acre approximately 22s. 6d.	
Cost per acre approximately 24s.			

The costs of these mixtures are based on last season's prices, which are considerably in excess of those likely to be charged this year.

Mixture No. 1 will probably give the most satisfactory results, but the cost is a little above what the average farmer feels inclined to pay. No. 2 mixture will also give good results, and the cost of this mixture should be within the reach of any farmer setting out to break in secondary-growth country. Wherever possible the farmer should save certain seeds that are of use in his sowings. This is especially to be desired in the case of danthonia, and where he can procure danthonia-seed in this way it is sound practice to increase the amount used. In no case should any of the ingredients recommended be cut down below the amounts as given for mixture No. 2, and under no consideration should any of the species be omitted and replaced by what the farmer may consider to be cheaper species. It should be remembered always that on hill country of the type here dealt with the cheapest seeds one can buy for the secondary-growth burn are brown-top, crested dogstail, white clover, and, in the third year, Lotus major. Perennial rye-grass is cheap for the first year, but then becomes rapidly dearer. Danthonia, although its seed is dear, is absolutely essential for carrying on the pasture on poor locations after the third year, and the writer feels confident that as time goes on this seed will turn out infinitely cheap.

On the warmer country where there is any chance at all of paspalum thriving mixture No. 3 should be sown. In districts that are comparatively dry—say, under 60 in. of rain—Lotus major is not at all likely to succeed, and brown-top will not thrive very well. In this case mixture No. 4 is recommended for the secondary burn.

These mixtures may be regarded as the most economical ones the farmer could sow. There are certain other species which might be added, and where the farmer feels like investing a few shillings more per acre on his country any one of the following may be added: $\frac{1}{2}$ lb. subterranean clover, $\frac{1}{2}$ lb. Lotus hispidus, 3 lb. Chewings fescue, 2 oz. yarrow; and on strong papa or limestone country $\frac{1}{2}$ lb. Poa pratensis and 4 lb. cocksfoot. With any one of these latter species, however, it is a gamble whether the money spent will ever be recouped. In the case of Danthonia pilosa prescribed in any one of the mixtures it should be clearly understood that where this grass is already well established on the country being burnt no more of the seed need be included in the sowing.

Time for Burning and Sowing.

Secondary growth should be burnt in the autumn, towards the latter end of March for preference, and the seed sown as soon after the burn as possible. If it can be sown while the ash is still warm, so much the better. In 1925 certain of our experimental sowings were made on areas burnt in the beginning of February of that year and not sown until the end of March. Volunteer growth of catsear, Scotch thistle, sweet vernal, Yorkshire fog, hawkweed, and suckling-clover was making its appearance at the time of sowing. The seed sown established poorly and very slowly, so that winter and cold weather came on before the seedlings were firmly established. Despite the fact that top-dressing of certain of these plots was carried out in the winter following the

burn, it was not until the following spring that any appreciable growth was made. On areas not top-dressed, burnt early in February and sown late in March, the growth has remained poor since the sowing, and it is highly doubtful whether more than one-tenth of the seed sown paid for its inclusion in the mixture.

For the more or less temporary elements in the mixture, at least, rapid establishment is imperative if the money spent in these is to be soundly invested. It seems evident that when one is spending money where the chances of loss are exceedingly great the utmost care should be taken to apply that money at the most opportune moment. Late sowings (after the middle of April) and sowings made on areas burnt months before the seeding takes place prejudice the chances of success. The seed one applies means money, and to waste money through spending at the wrong time is economically criminal. Early autumn burns are frequently a success, particularly so in the wet climate of the Taranaki back-country, but additional care must be taken to control the return of bracken. The writer does not advocate spring burning wherever any sowing is to be done, although frequently where one can concentrate stock to control the returning bracken success can be obtained. When dealing with hard fern, however, the spring burn is of no use. Certainly when the fronds are dead, killed by winter frosts, it is very tempting to burn this growth off; but at this time the ground is still damp and the fire is never sufficiently hot to roast the overground rhizomes, and consequently in a couple of years' time the hard fern is as bad as ever. In the late autumn, when the ground is dry, a good hot fire will kill most of the rhizomes. However, it does seem imperative—whether an area is burnt in the spring or early autumn—to get the seed on right away.

Burning to control secondary growth where a sufficiently satisfactory volunteer growth comes away after the burn, so that no further seeding is necessary, is a different matter to when sowing is being done. Once the necessary volunteers are present—that is, danthonia, paspalum, brown-top, or Lotus major established and lingering in the secondary growth—the best advice then is to burn whenever any possible chance occurs.

(To be continued.)

Classification of Pigs.—The number of pigs in the Dominion at the 1926 enumeration (including boroughs) was 472,534, an increase of 32,419 on the preceding year. The total was made up as follows: Pigs under one year old, 364,962; breeding-boars one year and over, 12,510; breeding-sows one year and over, 63,702; other pigs, 31,360.

Area of Orchards, Market Gardens, &c.—The official agricultural statistics for 1925-26 give the following particulars of this class of holdings in New Zealand: Commercial orchards (bearing, 19,876 acres; not bearing, 1,937 acres), 21,813 acres; private orchards, 5,255 acres; market gardens (excluding potatoes on $\frac{1}{2}$ acre and over), 4,599 acres; nurseries and seed-gardens, 505 acres; vineyards, 261 acres. Private orchards, for the purpose of the statistics, consist chiefly of small areas the produce of which is consumed principally on the holding, or, if sold, does not aggregate an annual value of £50.

MANURING OF EARLY POTATOES.

EXPERIMENTS IN AUCKLAND PROVINCE, 1926.

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THE growing of early potatoes is a feature of farming in certain districts in the Auckland Province. Free-working loams of good quality, combined with freedom from damaging frosts, are the natural factors favouring success. Though the yield of the early crop is comparatively light (from 5 to 6 tons per acre being considered quite satisfactory), the manuring is heavy, and the growers claim that very liberal manuring pays because of the high prices secured for the earliest "new" potatoes. Two crops and a crop of "seed" are taken in one season from the same ground. The residue of the manure from the early crop assists the main crop which follows.

Official statistics for 1925-26 show that an area of 2,900 acres was sown in potatoes in the Auckland and North Auckland Land Districts. As the information is collected in September of each year this area—which only includes areas of 1 acre or more—takes in all the crops intended for the early market as well as those to be sown for the main crop.

The usual rotation is potatoes after grass two or three years old. Some of the more progressive growers include a crop like mustard, which is ploughed in; it adds organic matter and assists drainage—a consideration of importance in the wet winters. Other cash crops, such as onions, mangolds, and carrots, are also grown.

The very early crops are generally taken, as stated, from favoured districts where the soil is a suitable free-working loam, and where frosts which do any damage rarely occur. The higher lands (which are high-priced) of Franklin County fall into this category. "The Hill" at Pukekohe is best known, and is one of the favoured places where potatoes are grown for the very early market, the crop coming in sometimes during the first week of September. The earliest consignments are sent to Wellington, and even to the South Island, where the wholesale price realized is 4d. to 5d. per pound. When the market weakens in the South, which usually occurs about early October, the potatoes are put on the Auckland market and are sold at 2d. to 3d. per pound. When the price goes down to 1½d. a pound or a little less the growers usually reduce supplies until the price advances. Last season 8,000 tons of potatoes were sent from Pukekohe, representing £72,000 in value. This season it is estimated that 9,000 tons will be trucked by 31st March.* Other districts which supply early potatoes are Kerikeri (Bay of Islands), Whangarei, Helensville, Avondale, the Waitakeres, Onehunga, Mangere, Papatoetoe, Papakura, Waiuku, and Taupiri. With a few exceptions, the potatoes are grown on volcanic soil. A factor which helps the grower with his early crop in these districts is that he has not the competition of growers in the South.

* Figures supplied by Mr. A. E. Lovell, Railway Stationmaster, Pukekohe.

The demand for early potatoes is increasing with the increase in population, and new districts are coming into the early-potato industry. These districts encounter less disease than the older places, and the new ground gives a better sample, as the shape comes back because of the greater vigour in the tuber.

Manuring of the early-potato crops in the older districts has undergone a great change from thirty years ago, when, and until recent years, a ton of bonedust per acre was the usual dressing. The increase in price of bonedust, together with the results of experiments in manuring, have been the chief factors in altering the manural prescription. Thirty years ago, when the early-potato industry was in its infancy in the province, bonedust was sold in Auckland at £5 12s. 6d. per ton; in 1914 the price was £8; to-day it is about £12. In 1922 it was higher still—in fact, it was quoted in Auckland at £23 a ton after the war, when all manures were scarce.

High prices directed attention to other fertilizers, such as the lower-priced phosphates, including superphosphate and ground raw rock. From a record recently made of twenty-two growers in the Pukekohe district it was found that fifteen used a mixture of super and bonedust, two used bonedust alone, and the remainder used proprietary manures. The average dressing per acre of growers using bonedust and super was 5 cwt. of super and 11 cwt. of bonedust. An average dressing of $1\frac{1}{2}$ cwt. of sulphate of potash was used in every case. It will be seen that for years bonedust was the only manure added, and although its increased price lead to the inclusion of super, large quantities of bonedust still formed the chief phosphatic dressing.

Scheme of the Experiments.

The aim of the experiments here recorded, established at Pukekohe, Taupiri, and Kerikeri, was to see how far a less costly phosphate could economically replace all or part of the bonedust. The mixtures used were as follows :—

(1) Bonedust		Per Acre.
Sulphate of potash		15 cwt.
		2 cwt.
		Per Acre.
(2) Bonedust	7½ cwt.	
Superphosphate (44-46) ..	7½ cwt.	
Sulphate of ammonia ..	1½ cwt.	
Sulphate of potash ..	2 cwt.	
(3) Superphosphate (44-46)	7½ cwt.	
Ephos phosphate ..	7½ cwt.	
Sulphate of ammonia ..	3½ cwt.	
Sulphate of potash ..	2 cwt.	

It will be seen that the amounts of phosphatic fertilizers were kept constant, but were different in type. In No. 2 mixture half the bone dust has been replaced by superphosphate, and in No. 3 all the bonedust has been replaced by a mixture of super and Ephos. The bonedust used was a locally manufactured green-bone product which is popular with the growers at Pukekohe; its analysis was 48.32 per cent. tricalcic phosphate, and 4.2 per cent. nitrogen. An equivalent amount of nitrogen was substituted where bonedust had been replaced by the addition of sulphate of ammonia. The amounts of nitrogen and potash were therefore kept constant in all the mixtures.

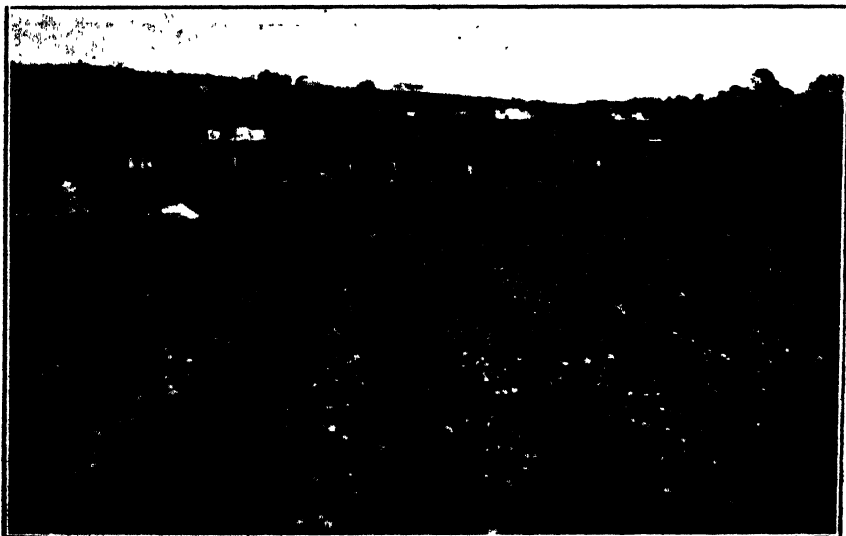
Each plot consisted of three rows of potatoes 28 in. apart, and was adjacent to a plot of different treatment. This series was continued several times across the field. When dug all the rows were weighed,

but only the weight of the middle row of each plot was taken for comparison. At all three locations cut sets of the "Gamekeeper" variety were used for seed, being planted by hand and ploughed in, the manure having previously been weighed out and applied along the face of the furrow.

Trial on Farm of E. J. Campbell, Pukekohe.

In this experiment sowing was done on 21st and 22nd June, and weighings made on 8th, 9th, and 10th November, 1926. The field selected for the experiment, although not having sufficient altitude to produce the earliest of crops, consists of a good friable volcanic loam typical of Pukekohe Hill. It had been in grass for many years, and there was a splendid sole previous to ploughing, providing a good supply of organic matter for the crop. The importance of this humus supply probably had a direct bearing on the result, as will be seen later. The rows were 7 chains long, and the series of plots were repeated six times across the field, so that each treatment was compared with another forty-two times when weighings were made at every chain.

Observations during Growth.—From the time the plants appeared above ground until digging, the super and Ephos plots, and to a lesser extent the super and bonedust plots, appeared to be ahead of the bonedust. This fact was noticed by several observers during the growth period. The haulms of the super plots ripened off quicker, and it may be safely maintained that the inclusion of super in the mixtures has been conducive to an earlier ripening. This is a most important consideration in the growing of early potatoes, since a gain of two or three days at digging-time may mean the difference of 1d. or more per pound in some seasons.



GENERAL VIEW OF THE EXPERIMENTAL PLOTS AT MR. CAMPBELL'S FARM, PUKEKOHE, TAKEN AT TIME OF DIGGING.

Basis of Comparisons.—All the rows were dug separately by hand and the tubers graded into marketable and small. At that time of the year potatoes were quoted at £12 per ton, which is a figure well below that ruling in recent years at the same period. In Table 1 and subsequent tables no value has been placed on the small unsaleable potatoes, since these are usually kept by the diggers.

The comparisons in all the tables have been worked out by "Student's" statistical method, under which a difference is regarded as significant when the chances are 30 to 1 or more in its favour.

Table 1.—Summary of Results at Pukekohe.

Type of Phosphate.	Yield per Acre.		Cost of Manures per Acre.	Value of Increase per Acre.	Profit per Acre.	Difference significant (S.) or non-significant (N.S.).
	Table.	Small.*				
15 cwt. super and bonedust	6 0.8	8.75	£ s. d. 9 12 5	£ s. d.	£ s. d.	
15 cwt. bonedust ..	5 14.4	7.50	10 10 0			
In favour of super and bonedust	12.4	1.25	..	6 4 0	7 1 7	S.
15 cwt. super and Ephos	6 9.0	7.25	8 18 9			
15 cwt. bonedust ..	5 13.4	7.50	10 10 0			
In favour of super and Ephos	15.6	..	..	7 16 0	9 7 3	S.
15 cwt. super and Ephos	6 9.0	9.0	8 18 9			
15 cwt. super and bonedust	6 6.8	9.2	9 12 5			
In favour of super and Ephos	2.2	..	..	1 2 0	1 15 8	N.S.

* Yield of small potatoes not treated statistically.

COMMENTS ON TABLE 1.

(1) Super and Ephos *versus* bonedust: The substitution of mineral phosphates has resulted in an increase of over 15½ cwt. of saleable potatoes, besides lessening the cost of manuring. Allowing £10 as the net value per ton after deducting the cost of digging and carting (£2 per ton), and adding the difference in the cost of manures, the profit derived has amounted to £9 7s. 3d. per acre.

(2) Super and bonedust *versus* bonedust: Here again the increase is appreciable, and the gain by substituting super for half the bonedust amounts to £7 1s. 7d. per acre.

(3) Super and Ephos *versus* super and bonedust: When these two are compared with one another there is a difference of 22 cwt. in favour of super and Ephos, representing a gain of £1 15s. 8d. per acre. This, however, is not significant when taken statistically.

The cost of manures taken in the above calculations was based on the prices ruling at the time of planting. The recent reductions in the price of superphosphate would show a still greater gain in the superphosphate mixtures.

Bonedust still has many adherents by reason of its "lasting" qualities or residual effects. One has often heard it said that "it is so good for the grassland afterwards." But a pound in the hand is probably worth more than two in the ground in these days when the slogan of "quick returns" is being increasingly applied to agriculture. What residual value would compensate for a cash increase of £9 per acre as in the case of super and Ephos, or £7 as in the case of super and bonedust? From our experiments in pasture top-dressing at Pukekohe it would pay better to spend money on 3 cwt. per acre of a suitable phosphate than depend on the residue of bonedust. An attempt is being made at Pukekohe and Taupiri to test the residual effect of the manures used in these experiments, and the results of this investigation will be published at a later date.

Trial on Farm of A. Wright, Kerikeri.

The Kerikeri district, Bay of Islands, has only recently been connected with the early-potato industry, but the mildness of its winter and its freedom from frosts make it ideally suited for that purpose as far as climate is concerned. The soil here is volcanic, of a pebbly ironstone nature, lighter than the Pukekohe soil, but lacking in humus. The only area available sloped in two directions, and thus running the rows across a slope was unavoidable. The field was previously in grass, but the turf was very poor, consisting mainly of Chewings fescue and danthonia. Consequently there was little addition of humus to the soil after ploughing.

Sowing was done on 12th and 13th May, and the crop was dug on 4th and 5th October, 1926. The rows were 5 chains long, and the series was replicated four times across the field so that twenty comparisons could be made.

Observations during Growth.—There was no appreciable difference between the individual rows at any time, except that those running along the foot of the slope looked better, and in fact weighed out better, than those at the top, a result obviously due to better fertility.

Comparisons of Yield.—All the rows were dug by hand and sorted into grade 1, grade 2, and small sizes, each grade being weighed separately. The price obtained for the first grade was 3d. per pound, and for second grade 1d. per pound, in the Auckland market. Particulars of results are set out in Table 2 (next page).

COMMENTS ON TABLE 2.

Super and bonedust *versus* bonedust: The combination of super and bonedust has at this centre shown its superiority over the other mixtures, and has given an increase of more than 10 cwt. over bonedust alone. This increase is valued at £12 10s., giving a profit of £13 5s. 9d. when compared, after allowing £2 per ton for digging and £2 10s. per ton for carting and freight to Auckland. The manures have been valued at the ruling price at planting, plus freight from Auckland.

Super and bonedust *versus* super and Ephos: The difference here has been remarkable, and the position as at Pukekohe entirely reversed. The super and bonedust gave an increase of over 19 cwt. of saleable potatoes when compared with super and Ephos. The profit derived

by using the former mixture amounts to £22 13s. 9d., a very large figure, magnified, no doubt, by the high price obtained for the produce.

Super and Ephos *versus* bonedust: The bonedust gave an increase in grade potatoes of 3 cwt. 81 lb., but this increase was counter-balanced by an increase of over 3 cwt. of second grade in favour of the super and Ephos. These results, however, are not significant when treated statistically, so that no reliance can be placed on them.

Table 2.—Summary of Results at Kerikeri.

Type of Phosphate.	Yield per Acre of Saleable Potatoes.				Cost of Manures per Acre.			Value of Increase per Acre.			Profit per Acre.		
	First Grade.	Second Grade.	Total.	Small.									
	Tons cwt. lb.	Tons cwt. lb.	Tons cwt. lb.	Cwt. lb.	£	s.	d.	£	s.	d.	£	s.	d.
15 cwt. super and bonedust	4 3 43	1 1 28	5 4 71	6 84	10	15	6						
15 cwt. bonedust	3 13 31	1 0 84	4 14 3	5 70	11	11	3						
In favour of super and bonedust	0 10 12	0 0 56	0 10 78	1 14				12	10	0	13	5	9
	S	N.S.	S										
15 cwt. bonedust	3 8 25	0 17 77	4 5 102	5 6 11	11	11	3						
15 cwt. super and Ephos	3 4 56	1 1 0	4 5 56	6 0 10	3	9							
In favour of bonedust	0 3 81	..	0 0 46	..				3	15	0	2	7	6
In favour of super and Ephos	..	0 3 35	..	0 106									
	N.S.	N.S.	N.S.										
15 cwt. super and bonedust	4 3 43	1 1 28	5 4 71	6 84	10	15	6						
15 cwt. super and Ephos	3 4 56	1 1 0	4 5 56	6 0 10	3	9							
In favour of super and bonedust	0 18 99	0 0 28	0 19 15	0 84				23	5	6	22	13	9
	S.	N.S.	S.										

S. = Significant difference; N.S. = Non-significant difference.

NECESSITY OF ORGANIC MATTER.

The results at Kerikeri for the past season go to show that super-phosphate can replace bonedust to a certain extent, but that under similar conditions bonedust cannot wholly be replaced. The explanation of this probably lies in the poor supply of humus in the Kerikeri soil. It has been repeatedly proved in the past that for yield the potato crop must have a good supply of organic matter to be a success. In Great Britain and on the Continent of Europe this demand is satisfied by a large application of farmyard manure. Up to 15 tons of farmyard manure per acre are applied, together with artificials. In fact, the conclusions arrived at by Hall after twenty-six years of manuring potatoes at Rothamsted are that the best

basis for the growth of potatoes is a supply of well-rotted farmyard manure. He goes on to state that in the absence of farmyard manure it should be replaced by some manure containing organic nitrogen. Now, while it is almost impossible in this country to make such an application of farmyard manure, the ploughing-in of a green crop or the turning-under of a good grass turf goes a long way towards supplying the potato crop with the necessary organic material.

At Pukekohe this object was attained, and the substitution of mineral fertilizers was highly successful. The supply of organic matter at Kerikeri was limited, consequently that same success with entirely mineral fertilizers has not been forthcoming.

Trial on Farm of S. V. Bilkey, Taupiri.

The soil at Taupiri is slightly heavier than the Pukekohe soil, and it varies to a certain extent. The area selected was formerly in grass, which was not of good quality, being largely composed of the twitches, but the soil itself was not lacking in organic matter.

Sowing was done on 30th June, and the crop was dug on 22nd and 23rd November, 1926. The rows were 4 chains long, but the series was replicated five times so that twenty comparisons could be made.

Observations during Growth.—As at Pukekohe, the super and Ephos plots went ahead soon after the plants were above ground, but this superiority was not maintained later in the season. The soil on one side of the area was heavier than the rest, and during the winter became very sticky. It was noticed when digging the crop that here the bonedust gave much better yields.

Table 3.—Summary of Results at Taupiri.

Type of Phosphate.	Yield per Acre.			Cost of Manures per Acre.			Value of Increase per Acre.			Profit per Acre.		
	Table.	Seed.	Total									
	Tons cwt. lb.	Tons cwt. lb.	Tons cwt. lb.	£	s.	d.	£	s.	d.	£	s.	d.
15 cwt. super and bonedust	4 8 49	1 11 0	5 19 49	9	12	5						
15 cwt. bonedust ..	4 3 43	1 6 0	5 9 43	10	10	0						
In favour of super and bonedust	0 5 6	0 5 0	0 10 6	..			6	0	8	0	18	3
	N.S.	N.S.	N.S.									
15 cwt. super and Ephos	4 16 2	1 0 68	6 5 70	8	18	9						
15 cwt. bonedust ..	4 12 56	1 6 30	5 18 86	10	10	0						
In favour of super and Ephos	0 3 58	0 3 38	0 6 90	..			4	2	3	5	13	0
	N.S.	N.S.	N.S.									
15 cwt. super and bonedust	4 8 49	1 10 40	5 18 89	9	12	5						
15 cwt. super and Ephos	4 16 2	1 0 68	6 5 70	8	18	9						
In favour of super and Ephos	0 7 65	..	0 6 93				4	1	11	4	15	7
In favour of super and bonedust	..	0 0 84										
	N.S.	N.S.	N.S.									

S. = Significant difference ; N S = Non-significant difference.

COMMENTS ON TABLE 3.

The odds here are not great enough to be regarded as significant, on account of the soil-variation, but the results go to show that both super and bonedust and super and Ephos tend to give better results than bonedust alone.

General Conclusions.

While it is rather risky to generalize from too few data, some important points stand out from the results secured so far. It must be remembered that as the tilth of the soil plays so important a part with potatoes the response to manures will vary very greatly with the thoroughness or otherwise of cultivation.

(1) Bonedust can be replaced partly and in some cases wholly by mineral phosphates.

(2) The inclusion of superphosphate in the mixture has in practically every case resulted in an increased yield, besides lessening the cost of the manure. Early ripening has also been encouraged.

(3) Where there is a good supply of humus in the soil it is probable that the use of bonedust can be dispensed with altogether, and a mixture of mineral phosphates such as super and Ephos substituted.

(4) The residual effects of bonedust are far outweighed by the increased return where super is used. In some cases this profit has amounted to more than the cost of the manure used. What effect the residues will have on the succeeding crop of potatoes will be probably seen later.

(5) These results were obtained in a season when the rainfall was about the average. There is every reason to suppose that in a drier season the odds would still further favour the water-soluble superphosphate.

(6) The results of these experiments suggest further investigations. Questions which should be answered by field trial are : (a) How far can super profitably replace slower-acting phosphates like bonedust and rock phosphates ? (b) Can the total amount of manure used per acre be economically reduced ?

We offer the growers, Messrs. B. V. Bilkey, E. J. Campbell, and A. Wright, our thanks for their co-operation in securing the results recorded. We thank Mr. A. E. Lovell, Stationmaster, Pukekohe, for information freely given. We also acknowledge the help rendered by our colleagues in the Fields Division.

Tenures of Land-holdings.—The official agricultural statistics give the following particulars concerning the tenures of occupied land in New Zealand for 1926 : Freehold (including land held on deferred payment), 20,451,217 acres ; Crown leases and licenses, 19,007,447 acres ; leases from private individuals or public bodies, 2,549,538 acres ; leases from Maoris, 1,598,482 acres ; unspecified, 145 acres. Freehold land formed 46.90 per cent. of the total area occupied in 1926, as compared with 47.06 per cent. in the preceding year.

TESTING OF PUREBRED DAIRY COWS.

REVIEW OF THE NEW ZEALAND CERTIFICATE-OF-RECORD SYSTEM IN 1926.

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THE support accorded to our certificate-of-record testing organization during the calendar year 1926 has been somewhat disappointing. The zenith of the testing was attained in 1924, during which year 933 purebred cows and heifers were granted certificates. For 1925 this number decreased to 800, while for the period under review—the calendar year 1926—only 576 yields were authenticated and certificates of record issued. The fact that the number of cows at present undergoing test is less than for the corresponding period a year ago would suggest that another season must pass before we can look for stronger support of this important branch of the Dairy Division's activities.

Many reasons for this depression have been advanced, but, while there are doubtless several contributing factors, the major cause can probably be found in the general economic stringency existing of late, which has made it difficult for many breeders to provide the extra care and feed that cows undergoing C.O.R. test generally require.

A few breeders have complained of the amount of the testing fee, while others have referred to the drop in the average sale price of purebred dairy cattle. When selling-prices fell so appreciably many breeders began to doubt whether C.O.R. testing was worth the trouble and expense. Breeders should not lose sight of the fact, however, that even with purebred-dairy-cattle prices at their lowest the difference in value between tested and untested strains is sufficient to more than recompense the cost and labour of testing. Another reason—and possibly a potent influence—is that for some years C.O.R. testing has been entered into by some breeders as a kind of record-breaking competition, and as time goes on higher records for class and breed leaderships become increasingly difficult to attain. The effect of this phase is a very far-reaching one. The ordinary breeder with an average herd, and average capital to expend on the handling of his herd, is more or less debarred from the outset, and the larger breeder restricts his test team to a few specially selected individuals upon which every care and much expense is bestowed. On the other hand, smaller breeders—that is to say, ordinary farmer breeders—should be encouraged by the fact that many of our best records have been made by them. And all breeders should remember that construction is more desirable than competition, and in this time of stress each must work for the ultimate good of all.

Some idea of the progress made in butterfat production under the C.O.R. system may be gained by comparing our summary for 1913 with that for 1926. The table which follows indicates the improvement in average production, class by class, of the certificated cows of the two most heavily represented breeds, the Friesians and the Jerseys.

Class.	Average Yield for 1913 Season.		Average Yield for 1926 Season.		Increase in Average Yield for 1926.
	Number of Cows.	Butterfat.	Number of Cows.	Butterfat.	
Jerseys.					
		lb.		lb.	lb.
Two-year	19	325·14	237	411·58	86·44
Three-year	17	379·61	61	491·43	111·82
Four-year	11	391·65	33	527·11	135·46
Mature	20	413·42	97	543·13	129·71
Friesians.					
		lb.		lb.	lb.
Two-year	13	336·67	54	423·38	86·71
Three-year	14	415·70	17	497·25	81·55
Four-year	4	379·84	11	585·59	205·75
Mature	17	431·90	28	549·41	117·51

The question of individual records is less important, though interesting. Appended is a comparison of the yields of the class-leaders in 1913 with those of 1926. Only the Jersey and Friesian breeds can be included, these being the only two breeds participating in 1912-13, the first year of the C.O.R. system. It may also be mentioned that at the outset only four classes were recognized, and the present classification has therefore been adjusted to permit of a convenient comparison. The figures are as follows :—

Class.	Yield of Butterfat in 1913.	Yield of Butterfat in 1926.	Increase in Highest Yield of Butterfat for Class.
<i>Jerseys.</i>			
	lb.	lb.	lb.
Two-year	524·29	708·40	244·17
Three-year	451·68	905·01	453·33
Four-year	430·71	780·32	349·61
Mature	514·92	1,056·40	541·48
<i>Friesians.</i>			
	lb.	lb.	lb.
Two-year	430·82	805·77	374·95
Three-year	644·54	863·51	218·97
Four-year	434·58	939·78	505·20
Mature	659·31	1,145·24	485·93

So far as the testing fee is concerned, one or two points may be briefly emphasized. The Dairy Division endeavours to combine the utmost efficiency with the utmost economy. Men of high calibre are appointed as testers under the C.O.R. system, and consequently these officers must be paid a higher salary than are testers in some other countries where the testing is carried out by juniors or college students. In order to keep down costs several of our testing officers add to the Department's revenue by conducting association herd-testing between their hours of checking the yield of purebred cows on C.O.R. test. Despite this fact the Department contributes about two-thirds of the

cost of carrying out the C.O.R. work. In addition, the various breeders' associations with whom we co-operate in conducting the testing provide liberal assistance by way of subsidies and awards, which still further decreases the breeders' share of the cost. Only the highest possible standard of authenticity is desirable, and the necessary service required to assure such authenticity cannot be run at low expenditure. C.O.R. records stand for all time, and permanent records are essential to purebred breeding operations. Until the number of cows per breeder is increased the testing fees cannot be lowered by the Department without further entrenching on the Consolidated Fund. Breeders can assist the State, the country, and themselves by increasing the size of their test teams. The average number of cows tested per breeder is at present about three and one-third. By increasing this number breeders can materially reduce the cost per record.

The period through which New Zealand breeders are now passing is much the same as that of those larger countries where similar testing work is carried on more extensively. Notably in the United States of America and in Canada the purebred-cattle business appears to have passed the nadir of its depression and is now on the ascendant. It is hoped that the depression in New Zealand will not be of longer duration than was the case in those countries.

CERTIFICATES ISSUED.

The total number of purebred dairy cows which have gained first-class certificates of record has now passed the five thousand mark, the exact figure at the end of 1926 being 5,329. During the past year certificates were issued to 498 cows on first performance, and to 78 cows on second or subsequent performances, the total being 576 certificates. The following table supplies details, the corresponding figures for 1925 being also given for purposes of comparison:

Breed	1926.			1925		
	Ordinary.	Repeat.	Total	Ordinary	Repeat.	Total
Jersey	372	50	428	501	98	599
Friesian	94	16	110	107	40	147
Milking Shorthorn	9	3	12	24	6	30
Ayrshire	15	1	16	20	3	23
Red Poll	8	2	10	6	1	7
Totals	498	78	576*	658	148	806

* Representing 575 cows, one cow having qualified for two certificates within the year.

Second-class Certificates.—During 1926, second-class certificates were issued for twenty-three Jerseys, eight Friesians, and one Milking Shorthorn. Grouping the cows of each particular breed into one class, the twenty-three Jersey records averaged 421.27 lb. butterfat, and the eight Friesians 518.47 lb. The Milking Shorthorn, a mature cow, yielded 489 lb. butterfat. The proportion of second-class certificates to first-class certificates of record continues to represent a negligible percentage, which suggests that breeders are doing all possible to have

their cows calve in time for a first-class C.O.R. Concerning this point of subsequent calving, it may be interesting to mention that for cows gaining first-class certificates of record the average number of days between calving for commencement of test and calving subsequent to test for cows gaining certificates in 1926 was 391 days. For cows qualifying for second-class certificates in the same year the average period was 470 days. Readers will doubtless be conversant with the fact that our C.O.R. rules governing calving provide that for a first-class certificate of record the period between calving for commencement of test and calving subsequent to test shall not exceed 455 days (fifteen months), while for a second-class certificate of record the period is extended to 485 days (sixteen months).

JERSEYS.

Class-leaders.

The year under review brought two changes in Jersey class-leaders, and in each of these cases the previous highest record for the class was raised by an appreciable amount. Mr. P. J. Petersen's Ivondale Golden Rainbow, which gained a certificate for 768·46 lb. butterfat, displaced Mr. W. J. Chynoweth's Marshland's Stylish Princess for the senior two-year-old leadership by 52·71 lb. The three-year-old Loo's Queen (Mr. A. Christie), with 797·32 lb. fat, gave way to Ivondale Golden Lass, with 905·01 lb., a difference of no less than 107·69 lb. This cow, which was also bred and tested by Mr. P. J. Petersen, is now owned by Mr. A. E. Watkin, of Takanini, and Ivondale Golden Rainbow by Mr. Truby King, Stratford.

The Jersey class-leaders now stand as follows :—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season.		
				Days.	Milk.	Fat.
<i>Junior Two-year-old.</i>		<i>Yrs. dys.</i>	<i>lb.</i>		<i>lb.</i>	<i>lb.</i>
Keston Flower ..	G. E. Yelchich, Waiuku	1 359	240·5	365	11,422	604·28
<i>Senior Two-year-old.</i>						
Ivondale Golden Rainbow	P. J. Petersen, Waitara	2 311	271·6	365	12,962·2	768·46
<i>Three-year-old.</i>						
Ivondale Golden Lass	P. J. Petersen, Waitara	3 312	308·2	365	14,434·8	905·01
<i>Four-year-old.</i>						
St. Lambert's Bell ..	A. J. Smith, Cardiff ..	4 283	341·8	365	14,423·1	780·32
<i>Mature.</i>						
Holly Oak's Annie ..	W. T. Williams, Pukehou	5 9	350·0	365	18,522·7	1,036·49

Jersey Class-averages.

The average C.O.R. Jersey for 1926 produced 461·68 lb. butterfat, which, compared with 1925 at 458·91 lb., shows an increase of 2·77 lb. The length of average lactation—346 days—remains the same for both years. Of the 428 Jerseys certificated last year no less than 186, or about

43½ per cent. of the total, are in the class for cows calving for commencement of test at the age of 2 years 92 days or under—that is, the junior two-year-old. A perusal of the table of class-averages will show that for this breed every class except the senior two-year-old shows a creditable increase over the class-average for the preceding twelve months. The senior two-year-olds dropped slightly by 2.42 lb. butterfat. Some 428 certificates were awarded to Jersey cows, as compared with 599 for 1925.

The class-averages for 1926 and 1925 are given in the following table :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
1926.				
			lb.	lb.
Junior two-year-old ..	186	347	7,128.7	399.62
Senior two-year-old ..	51	340	8,059.6	455.22
Three-year-old ..	61	345	8,784.8	491.43
Four-year-old ..	33	347	9,405.9	527.11
Mature ..	97	350	9,794.1	543.13
1925.				
Junior two-year-old ..	237	344	7,132.1	395.71
Senior two-year-old ..	59	347	8,154.6	457.64
Three-year-old ..	79	346	8,634.7	480.85
Four-year-old ..	47	352	9,484.4	523.82
Mature ..	177	345	9,501.6	516.94

The following table shows the averages, class by class, of all certificates issued to Jersey cows since the commencement of the C.O.R. system in 1912 :—

Class.	Number of Certificates.	Average Yield for Season		
		Days in Milk	Milk	Butterfat.
			lb.	lb.
Junior two-year-old ..	1,570	345	6,918.1	385.80
Senior two-year-old ..	444	344	7,668.6	430.67
Three-year-old ..	636	342	8,298.1	418.97
Four-year-old ..	388	344	8,703.8	425.35
Mature ..	1,052	345	9,276.1	507.15
All ..	4,090	344	7,995.8	443.22

Jersey C.O.R. Bulls.

As breeders will be aware, a bull is entitled to be called a certificate-of-record bull when he has sired four certificate-of-record daughters, each daughter being from a different dam. In addition, the Jersey Breeders' Association recognizes a special class for what it terms champion butterfat bulls. A champion butterfat bull is one which has at least five C.O.R. daughters from different dams, each daughter having doubled its minimum butterfat requirement for certificate. Up to the

end of 1926 some 247 Jersey bulls had qualified for the C.O.R. list, while ten of these were eligible for inclusion in the champion class. In the appended list champion butterfat bulls are marked †. On account of the dimensions which our C.O.R. bull lists have now attained it has been found necessary to abandon the publication of the full list each year, and to give instead only those C.O.R. bulls which have added to their number of C.O.R. daughters during the year, or have during that period newly qualified for the class. The list is as follows:—

Key to numbers opposite names: First number—first-class C.O.R. daughters; second number—ditto, qualified on subsequent performances; third number—second-class C.O.R. daughters; fourth number—total of preceding three numbers. Bulls marked * qualified for C.O.R. list in 1926.

Grannie's Knight†	..	50	9	3	62	Ivondale's Rainbow	..	7	2	0	9
Te Rapa Lad	..	25	2	0	27	Avoca's Protection	..	7	1	0	8
Viola's Golden Laddie	..	21	6	1	28	Rita's Molina	..	7	1	0	8
Neathead's Majesty	..	18	5	2	25	Golden Swan's Lad	..	7	1	0	8
V.C.†	..	18	3	0	21	Napper	..	7	0	0	7
Belvedere Bilberry's Last	17	1	0	18	Miro Meadows Glaxo	..	7	0	0	7	
Soumise Tom†	..	16	2	2	20	Una's Nobility	..	7	0	0	7
Waipiko Masterpiece†	..	16	3	1	20	Aster's Golden Lad	..	6	2	0	8
The General	..	15	6	2	23	Beachlands King Pin	..	6	2	0	8
Sunflower's Perseus†	..	15	4	0	19	Belvedere Sun King	..	6	1	0	7
Meadowvale Conqueror	15	2	0	17	Golden Reef*	..	6	1	0	7	
Bilberry's Twylish†	..	15	1	2	18	K See 7th	..	6	0	2	8
The Owl's Victor	..	15	0	2	17	Beechlands Field Marshall	6	0	0	6	
Hawkesbury Emperor	..	14	5	0	19	Iliaeus*	..	6	0	0	6
Bilberry's Goddington	..	14	3	0	17	Marshlands Masterpiece*	0	0	0	6	
Renown of Meadowbrook	14	3	0	17	Molly's Lad	..	6	0	0	6	
Bridge View's Magnet	..	13	0	0	13	Miro Meadows Toby	..	6	0	0	6
Pecuarious	..	13	0	0	13	Majesty's Eminent*	..	6	0	0	6
Owler of Puketapu†	..	12	0	2	14	Ravenswood Model	..	6	0	0	6
Rainbow's King†	..	11	3	1	15	Vulpes of Bull's	..	6	0	0	6
Maid's General	..	11	2	1	14	Willowbrook Lord*	..	6	0	0	6
Eileen's Fox	..	10	2	0	12	Middlewood's Eminent	..	5	2	1	8
Charm's Lord	..	10	1	1	12	Tiki's Twylish*	..	5	2	1	8
Meadowvale General						Beachlands Leo	..	5	0	0	5
Daisy	..	10	0	1	11	Capsicum's Maple	..	5	0	0	5
Brampton Merry Boy	..	10	0	0	10	Miro Meadows A I.*	..	5	0	0	5
Masterpiece of Meadowbrook	..	10	0	0	10	Noble Warder	..	5	0	0	5
Distinction's Twylish	..	9	0	1	10	Queen's Glory Lad	..	5	0	0	5
Fox's Double	..	9	0	0	9	Fox's Ring*	..	4	0	1	5
Woodstock Golden Lad	8	1	1	10	Maid's Egyptian General*	4	0	1	5		
Shamrock of Beachlands	8	1	0	9	Froth*	..	4	0	0	4	
Grannie's Campanile Sultan	..	8	1	0	9	Hawkesbury Golden Light*	..	4	0	0	4
Belvedere Silver Trumpeter	..	8	0	0	8	Magnet's Glory*	..	4	0	0	4
Waipiko Leonard	..	8	0	0	8	Monarchist*	..	4	0	0	4
Miro Meadows Maori Boy	7	3	0	10	Orange Dale Draconis*	4	0	0	4		
					St. Aubin's Golden Lad*	4	0	0	4		
					Willow Brook Admiral*	4	0	0	4		

FRIESIANS.

Class-leaders.

It is now three years since the list of Friesian class-leaders experienced any changes. While several good yields have been authenticated during the past calendar year none has been sufficiently high to supplant the existing class-record. Only quite exceptional cows can hope to do that, so that further changes will doubtless be slower in coming than in the early years of C.O.R. testing. In order to preserve the completeness of this review the list is here repeated.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat required for Certificate.	Yield for Season		
				Days.	Milk.	Fat.
<i>Junior Two-year-old.</i> Monavale Queen Bess	T. H. Richards, Cardiff	<i>Yrs. d.ys</i> 2 16	<i>lb.</i> 242·1	365	20,501 1	740·50
<i>Senior Two-year-old.</i> Netherland Princess 4th	John Donald, Westmere	2 34 1	274·6	365	19,621 6	805·77
<i>Junior Three-year-old.</i> Monavale Queen Bess	T. H. Richards, Cardiff	3 56	282·6	365	21,609·3	800·18
<i>Senior Three-year-old.</i> Manor Beets Daughter 2nd of Ashlynn	C. A. Hopping, Palmers- ton North	3 29 6	306·6	365	18,733·9	863·51
<i>Junior Four-year-old.</i> Westmere Princess Pietertje	John Donald, Westmere	4 15 6	329·1	365	24,199·0	939·78
<i>Senior Four-year-old.</i> Bainfield 27th	C. H. Potter, Pukerau	4 35 1	348 6	365	23,203 3	910 74
<i>Mature.</i> Alcartra Clothilde Pietje	Vernon Marx, Manga- toki	7 355	350·0	365	31,312·5	1,145 24

Friesian Class-averages.

Of the seven classes into which the Friesian breed is subdivided four show increases for 1926 as compared with 1925, while three have not maintained the average production of the preceding year. As is the case with the Jersey breed, the junior two-year-old class is numerically the strongest, and in the Friesian breed this class represented almost 40 per cent. of the total certificates issued for the year. In total numbers 110 certificates were issued to Friesians in 1926, as against 147 in 1925. In the latter year the average C.O.R. Friesian was credited with 499·93 lb. butterfat, while for 1926 this has decreased to 483·10 lb. fat. In considering this decrease, however, we must not lose sight of the fact that many of the classes are sparsely represented, and individual performances, therefore, have a marked influence on the breed average. The figures for 1926 and 1925 are as follows:

Class.	Number of Cows.	Average Yield for Season		
		Days in Milk.	Milk.	Fat.
		1926	lb.	lb.
Junior two-year-old	43	331	11,479·7	405·80
Senior two-year-old	11	356	14,086·2	492·10
Junior three-year-old	9	357	12,727·7	458·16
Senior three-year-old	8	331	14,114·1	541·22
Junior four-year-old	7	348	17,144·2	598·87
Senior four-year-old	4	348	17,062·3	562·36
Mature	28	348	15,723·4	549·41

FRIESIAN CLASS-AVERAGES—*continued*.

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
1925.			lb.	lb.
Junior two-year-old ..	44	349	12,094·8	428·09
Senior two-year-old ..	13	357	12,565·3	442·42
Junior three-year-old ..	13	319	12,048·5	436·60
Senior three-year-old ..	11	328	13,358·8	492·47
Junior four-year-old ..	5	336	15,458·6	548·46
Senior four-year-old ..	8	352	16,301·8	581·85
Mature	53	332	16,559·3	573·82

The following table shows the averages, class by class, of all certificates issued for Friesian cows since the commencement of C.O.R. testing in 1912:—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Junior two-year-old ..	416	345	11,232·4	398·86
Senior two-year-old ..	190	347	12,238·9	433·23
Junior three-year-old ..	146	341	13,071·7	459·73
Senior three-year-old ..	143	339	13,639·3	486·07
Junior four-year-old ..	92	342	14,581·7	514·91
Senior four-year-old ..	86	347	15,658·5	542·07
Mature	416	339	15,391·1	537·93
All	1,489	343	13,397·4	471·89

Friesian C.O.R. Bulls

The Friesian C.O.R. bulls now total eighty-eight, and of these sixteen are eligible for inclusion in the present summary. Three new names were added during the year. The list is as follows:—

Key to numbers opposite names: First number—first-class C.O.R. daughters; second—ditto, qualified on subsequent performances; third—second-class C.O.R. daughters; fourth—total of preceding three numbers. Bulls marked * qualified for C.O.R. list in 1926.

Rosevale Korndyke		Salma Torohunga No. 1	7	0	0	7
Sylvia Posch .. 15 11 2 28		Woodcrest Pontiac				
Rosevale King Sylvia .. 13 3 3 19		Alcartra ..	6	2	1	9
King Laddie .. 8 2 1 11		Dominion de Kol Domino	6	2	0	8
Black and White King		Dominion Woodcrest				
of Ashlynn .. 8 0 1 9		King Segis of Rock ..	6	0	0	6
Felix de Kol of Monavale		Brooklands Waihi Segis	5	1	0	6
Dominion Woodcrest		Bonheur King*	5	1	0	6
Beets .. 7 0 0 7		Rosevale Plus Triumph	5	1	0	6
Ensign Pontiac Valdessa		Rex Paxton of Monavale*	5	0	0	5
Fayne* .. 7 0 0 7		Best of Tikorangi*	4	0	0	4

AYRSHIRES.*Class - leaders.*

The past year saw several good Ayrshire certificates gained, but failed to bring any changes to the class-leaderships of the breed. The list as it stood at the end of 1925 is accordingly reprinted, as follows :—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat
<i>Two-year-old.</i>		<i>Yrs. dys.</i>	<i>lb.</i>		<i>lb.</i>	<i>lb.</i>
Fair Maid of Green bank	W Moore, Homebush	2 27	243·2	365	12,281·3	673·56
<i>Three-year-old.</i>						
Ivanhoe Stylish Daisy	A. M. Weir, Menzies Ferry	3 312	308·2	365	12,334·2	574·09
<i>Four-year-old.</i>						
Ivanhoe Fancy ..	A. M. Weir, Menzies Ferry	4 308	344·3	365	14,207·7	713·93
<i>Mature.</i>						
Glencairn Brownie ..	A. Montgomerie, Kawhata	8 360	350·0	365	15,579·4	728·05

Ayrshire Class-averages.

The Ayrshire breed occupies a similar position to that of the other C.O.R. breeds in that it was represented to a lesser extent in 1926 than in the preceding year. The number of certificates issued was sixteen for 1926 and twenty-three for 1925. The average yield also showed a falling-off, principally due to the influence of the 1926 two-year-olds, whose production was considerably below the usual average in that class of the breed. The mature class included some very fine records—one at 695 lb., one at 678 lb., and another at 586 lb. butterfat—but these were not enough to bring the average up to that of 1925. The 1926 breed average was 440·31 lb. butterfat, and that for 1925 some 73 lb. higher. The class-averages for 1926, together with those for the preceding year, are as follows :—

Class	Number of Cows.	Average Yield for Season.		
		Days in Milk	Milk.	Fat.
		1926.	lb.	lb.
Two-year-old	3	339	6,454·6	274·22
Three-year-old	1	333	7,897·7	371·73
Four-year-old	2	365	11,420·2	405·22
Mature	10	360	13,125·0	504·01
		1925.		
Two-year-old	5	305	12,298·0	512·54
Three-year-old	2	341	9,162·6	354·84
Four-year-old	3	345	14,043·4	549·24
Mature	13	348	12,743·0	529·69

The following table shows the averages, class by class, of all certificates issued to Ayrshire cows since the commencement of C.O.R. testing in 1912 :—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
Two-year-old	43	343	lb. 8,769·9	lb. 358·15
Three-year-old	27	347	9,813·4	400·85
Four-year-old	21	349	11,320·4	458·42
Mature	85	349	11,808·5	484·62
All	176	347	10,701·6	437·74

Ayrshire C.O.R. Bulls.

Six Ayrshire bulls are again qualified for the C.O.R. bull list, the number being unaltered since last year's review. Only one bull, Hindsward Jimmie of Townhead, has added to his number of C.O.R. daughters during the year, his figures being 13-1-0-14.

MILKING SHORTHORNS.

Class-leaders.

One change has taken place in the Milking Shorthorn class-leaderships, this falling in the senior two-year-olds. Mereside Gem, with 461·52 lb. butterfat, and tested by Mr. W. Bowis, Doyleston, gives way to Messrs. Ranstead Bros.' Matangi Quality 5th, with 542·66 lb. It will be noted that of the seven classes recognized by the Milking Shorthorn Association six leaderships are held by cows bred and tested by Messrs. Ranstead Bros., of Matangi—a remarkable achievement. The list is as follows :—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
<i>Junior Two-year-old.</i> Matangi Quality 4th	Ranstead Bros., Ma-	Yrs. dys.	lb.		lb.	lb.
	tangi	2 109	251·4	365	14,572·8	591·89
<i>Senior Two-year-old.</i> Matangi Quality 5th	Ranstead Bros., Ma-	2 204	260·9	365	11,752·8	542·66
	tangi					
<i>Junior Three-year-old.</i> Matangi Quality 4th	Ranstead Bros., Ma-	3 153	292·3	365	16,281·4	678·02
	tangi					
<i>Senior Three-year-old.</i> Matangi Ruth 2nd ..	Ranstead Bros., Ma-	3 304	307·4	365	14,032·7	747·86
	tangi					
<i>Junior Four-year-old.</i> Matangi Nancy 2nd	Ranstead Bros., Ma-	4 3	313·8	365	15,591·6	608·28
	tangi					
<i>Senior Four-year-old.</i> Matangi Ruth 2nd ..	Ranstead Bros., Ma-	4 355	349·0	340	11,670·3	644·90
	tangi					
<i>Mature.</i> Glen Thorpe Lady ..	A. J. Melville, Buckland	Mature	350·0	365	20,136·2	856·85

Milking Shorthorn Class-averages.

During the year under review twelve certificates were issued to Milking Shorthorn cows, as compared with thirty certificates for 1925. The average yield of the twelve cows certificated last year was 508·89 lb. butterfat, which is some 30 lb. above the 1925 average of 478·38 lb. Here, again, the influence of individual records is considerable, five of the seven classes having only one representative each. The class-averages for the Milking Shorthorn breed for the past two years are as follows :—

Class.	Number of Cows.	Average Yield for Season.		
		Days in Milk	Milk.	Fat
1926.				
			lb.	lb.
Junior two-year-old ..	3	346	10,448·8	435·19
Senior two-year-old ..	1	305	11,752·8	542·66
Junior three-year-old ..	1	300	8,978·2	361·77
Senior three-year-old ..	1	305	13,954·6	688·75
Junior four-year-old ..	1	361	10,142·8	402·19
Senior four-year-old ..	1	305	14,850·0	635·91
Mature	4	337	13,893·9	542·45
1925				
Junior two-year-old ..	7	345	8,943·7	367·18
Senior two-year-old ..	1	305	11,286·3	461·52
Junior three-year-old ..	1	305	11,790·5	498·93
Senior three-year-old ..	2	330	10,344·5	463·93
Junior four-year-old ..	3	345	9,598·5	423·88
Senior four-year-old ..	1	300	12,081·1	498·11
Mature	15	335	13,380·3	541·55

The following table shows the averages, class by class, of all certificates issued to Milking Shorthorn cows since the commencement of C.O.R. testing for this breed in 1914 :—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Junior two-year-old ..	40	352	8,520·3	352·33
Senior two-year-old ..	23	346	8,459·0	341·23
Junior three-year-old ..	19	334	9,594·2	381·27
Senior three-year-old ..	17	344	10,839·8	463·43
Junior four-year-old ..	16	349	10,501·0	422·23
Senior four-year-old ..	17	347	11,927·5	480·58
Mature	211	341	11,514·6	459·06
All	343	343	10,815·1	433·09

Milking Shorthorn C.O.R. Bulls.

The C.O.R. bulls of this breed total five, the number remaining the same as at the close of 1925. Only one bull, Marlborough of Darbalara,

has added to his number of C.O.R. daughters during the year. His figures now stand at 6-0-0-6 (see key at head of Jersey or Friesian list).

RED POLLS.

Class - leaders.

The year under review brought one change of class-leadership to the Red Poll breed. This occurred in the four-year-old class, where Mr. B. W. Harvey's Susie Ann, with 448·48 lb. butterfat, superseded the Central Development Farm's Dominion Opticia by a margin of 7·21 lb. The present class-leaders are as follows :—

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days	Milk.	Fat
<i>Two-year-old.</i> Wayward 6th B No. 1	G. S. Young, West Plains	Yrs. dys. 2 188	lb. 259·3	365	11,228 0	511·42
<i>Three-year-old.</i> Dominion Gold Top..	Central Development Farm, Weraroa	3 302	307·2	365	9,491·25	459·46
<i>Four-year-old.</i> Susie Ann	B. W. Harvey, Waverley	4 65	320·0	354	11,109·3	448·48
<i>Mature.</i> Dominion Sylph ..	Central Development Farm, Weraroa	5 4	350·0	365	11,009·00	505·84

Red Poll Class-averages.

During 1926 ten Red Polls gained certificates, an increase of three over the preceding year. Only three of the four classes were represented, no three-year-olds having been under test. The class-averages for 1926 and 1925 are as follows :—

Class.			Number of Cows.	Average Yield for Season.		
				Days in Milk.	Milk.	Fat.
1926.						
Two-year-old	..	..	4	322	lb. 7,257·9	lb. 306·86
Four-year-old	..	..	1	354	11 109·3	448·48
Mature	..	..	5	312	9,239·3	385·13
1925.						
Two-year-old	..	..	6	346	7,938·9	365·97
Three-year-old	..	..	1	333	9,185·6	410·39

The following table shows the averages, class by class, of all certificates issued to Red Poll cows since the commencement of C.O.R. testing for this breed in 1918 :—

Class.	Number of Certificates.	Average Yield for Season.		
		Days in Milk.	Milk.	Fat.
			lb.	lb.
Two-year-old	26	339	7,547.0	339.58
Three-year-old	11	343	8,066.4	351.85*
Four-year-old	5	340	9,233.0	395.02
Mature	15	325	9,693.0	419.20
All	57	336	8,359.9	367.75

* No additional cows.

Red Poll C.O.R. Bulls.

No new Red Poll bulls have been added to the list during the year, and none of the bulls previously qualified has added to his number of C.O.R. daughters. The three Red Poll C.O.R. bulls are Aviator, Belligerent, and Force Majeure.

The secretaries of those breeders' associations who co-operate with the Dairy Division in the carrying-out of the C.O.R. testing are constantly rendering valuable assistance, and we thank once again the various officers concerned—Messrs. W. M. Tapp (Jersey), J. P. Kalaugher (Friesian), W. Hunter (Milking Shorthorn), R. H. Spencer (Ayrshire), and L. J. Wild (Red Poll).

NOTE. - The closing list of records for cows which gained certificates in 1926 will be published in next month's *Journal*.

EXPORT OF PUREBRED DAIRY CATTLE.

IN 1926 a total of forty-one head of purebred dairy cattle were exported from New Zealand. Of these, fourteen went to Argentina, twenty-three to Australia, three to Fiji, and one to Tonga, their total declared value being £3,521. This compares with ninety-three head of a value of £5,200 exported for the preceding year. It will be noted that, though the number of cattle exported showed a falling-off, the average value per head shows a very marked increase.—*Dairy Division*.

Minor Materials and Products of the Hive.—Pollen is collected on the body-hairs of the bee, and is carried to the hive in the pollen-baskets on the posterior legs. Stored in the cells adjacent to the brood, it is mixed with honey, and is fed as required by the nurse bees in the process of feeding the young larvæ. Lack of pollen retards, if not altogether prevents, the bees from rearing the young during the larval stage. Propolis, or bee-glue, is a resinous substance gathered by the bees from the buds and limbs of trees. It is used to stop up cracks and crevices in the hives, more particularly in the autumn months. Propolis is troublesome to the beekeeper in some districts, making it well-nigh impossible to manipulate the frames unless they are staple-spaced. Tar is often gathered in liberal quantities as a substitute for propolis. Beeswax is not gathered by the bees, as is commonly supposed, but is produced during the process of comb-building. A high temperature is necessary for the secretion of wax. The bees hang in clusters in a state of repose, consuming honey in the meantime, which, being converted into wax, is formed into scales on the wax-plates on the under-side of the abdomen of the workers. It is estimated that from 10 lb. to 12 lb. of honey is consumed to produce 1 lb. of wax.—*Bulletin No. 128, "Beekeeping."*

THE OFFICIAL SEED-TESTING STATION.

RECORD OF OPERATIONS FOR 1926.

N. R. Fov, Seed Analyst, Biological Laboratory, Wellington.

FOR the twelve months ended December, 1926, 8,627 seed-samples were tested at the Seed-testing Station of the Agriculture Department, showing an increase of 481 over the previous year. The aggregate was made up as follows: Commercial samples, 6,852 (fees payable); commercial retests, 143 (gratis); farmers' samples, 399 (gratis); Government Departments' samples, 289; special laboratory tests, 944.

Germination test only was required for 6,731 of the samples; purity only for 111 samples; and both purity and germination for 1,785 samples. An increase in the number of samples received from farmers—399, as compared with 203 in 1925—is noticeable.

Table 1.—Number of Samples received in each Month, 1926 and 1925.

Month.	Number.		Month.	Number.	
	1926.	1925.		1926.	1925.
January	642	553	July	739	537
February	560	700	August	994	852
March	753	878	September	907	895
April	546	659	October	1,096	740
May	650	592	November	723	683
June	616	674	December	401	403

Table 2.—Number of Samples tested of the various Species (excepting Special Laboratory Tests), 1926 and 1925.

Species.	1926.	1925.	Species.	1926.	1925.
Lucerne	85	62	Paspalum	113	77
Alsike	69	75	Poa pratensis	66	60
White clover	333	257	Prairie-grass	34	25
Cow-grass and red clover	317	276	Other grasses	65	61
Crimson clover	23	35	Japanese millet	32	28
English trefoil	31	38	Oats	31	48
Lotus major	83	55	Other cereals	50	42
Other clovers	73	60	Mangolds	171	249
Perennial rye-grass	1,744	1,178	Turnips	372	449
Italian rye-grass	255	260	Swedes	288	290
Western Wolths rye-grass	181	194	Rape	115	184
Timothy	88	97	Kale	35	46
Crested dogstail	768	874	Chou moellier	40	38
Danthonia spp.	68	99	Carrots	101	89
Brown-top	171	124	Mustard	20	32
Chewings fescue	554	431	Forest-tree seeds	77	23
Meadow-fescue	29	37	Flower-seeds	6	14
Meadow-foxtail	39	49	Vegetables (other than peas)	143	250
Yorkshire fog	16	25	Peas (garden)	133	197
Cocksfoot	433	387	Tares, vetches, &c.	14	12

The date distribution of the samples received throughout the year is shown in Table 1, and the number of samples of each species is shown in Table 2, both being compared with the preceding year.

Table 3 shows the number of samples received from the different land districts. If these figures are compared with the accompanying maps it will be seen that, excepting Auckland, most of the testing is concerned with seed production and export. The bulk of the imported samples, together with about half of the local retail samples, are received from Auckland, while those from Wellington are divided almost equally into retail, export, and production (Manawatu) groups. A small proportion of the Southland, Canterbury, and Otago samples are concerned with the retail business, but production and export are responsible for by far the greater portion.

Table 3.—Number of Samples received from Merchants and Farmers in the Different Land Districts.

District.			Number.	District.			Number.
Southland ..	..	..	1,979	Marlborough ..	..	..	129
Wellington ..	..	..	1,900	Taranaki ..	..	..	59
Auckland ..	..	..	1,320	Gisborne ..	..	..	9
Canterbury ..	..	..	1,142	Nelson ..	..	..	8
Otago ..	..	..	599	North Auckland ..	..	..	3
Hawke's Bay ..	..	..	228	Westland ..	..	..	Nil.

NOTE.—Nine samples were also received from New South Wales

Table 4.—Average Germination and Purity of the Main Grasses, 1926

NOTE.—Average germination of various species for 1925 given in parentheses after 1926 figures in second column

Species.	Percentage of Germination.			Percentage of Samples germinating between							Average Percentage of Impurities.	
	Average.	Highest	Lowest.	0-50.	51-60.	61-70.	71-80.	81-90.	91-100.	Useful Seeds	Weed Seeds	
Perennial rye-grass	77 (85)	100	19	4	0	15	24	31	20	1.3	0.4	
Italian rye-grass	87 (87)	100	43	1	1	3	12	39	44	0.1	0.2	
Western Wolth's rye-grass	81 (88)	100	43	1	2	2	15	37	43	0.3	0.1	
Timothy ..	91 (84)	100	26	2	3	..	5	17	73	0.3	0.3	
Crested dogstail ..	84 (79)	100	..	5	3	8	11	24	49	2.0	0.3	
Cocksfoot ..	69 (69)	95	9	9	14	21	27	26	3	3.7	0.9	
Brown-top* ..	78 (67)	100	3	13	8	12	10	17	40	1.0	1.0	
Chewings fescue ..	82 (73)	100	2	9	2	3	10	34	42	0.6	0.3	
Meadow-fescue ..	63 (73)	99	2	41	..	3	14	14	28	0.1	0.5	
Poa pratensis ..	48 (51)	95	7	49	23	14	11	..	3	0.2	0.5	
Meadow-foxtail ..	36 (21)	50	1	40	46	31-40.	41-50	51-60.	61-70.	1.6	4.6	
Danthonia spp. ..	46 (38)	80	..	9	15	19	15	13	29	7.7	4.9	
Paspalum ..	38 (48)	77	2	14	16	22	33	7	8	0.3	0.2	

* Contained an average of 33 per cent. chaff.

GRASSES.

Germination.—The average percentages of purity and germination of the main grass-seeds are shown in Table 4. The most noticeable feature is the decline in the average germination of perennial rye-grass, and the rise in that of crested dogstail and Chewings fescue, as compared with the preceding year. This demonstrates an interesting point—the difference in the humidity requirements during ripening of rye-grass and of Chewings fescue and dogstail. Both the depression in rye-grass and the rise in the other two species are due almost entirely to the wet conditions prevailing in Southland during the 1926 harvest. Rye-grass cannot tolerate humid conditions during the final maturation processes; the hotter and drier the atmosphere the better. The appearance of the seed and the weight are not materially altered, but the germ is either weakened or fails to mature. On the other hand, dogstail and Chewings fescue under these same conditions produced a very good quality seed, high humidity being favourable to complete maturation, and dry, hot weather usually unfavourable.

Table 5.—Average Germination and Purity of Perennial Rye-grass, Crested Dogstail, Cocksfoot, and Chewings Fescue, grouped according to Place of Origin, 1926 and 1925.

Origin.	Average Per- centage of Im- purities.	Percentage of Samples germinating in Groups—								Average Germina- tion.		Number of Samples.	
		Under 7c.		71-80.		81-90.		91-100.		1925	1926.	1925.	1926.
		1925.	1926.	1925.	1926.	1925.	1926.	1925.	1926				
<i>Perennial Rye-grass.</i>													
Southern ..	1.6	6	36	6	30	36	29	52	5	88	74	421	963
Canterbury	1.8	7	12	12	22	34	37	47	29	87	83	258	363
Sandon ..	0.5	61	18	13	16	17	32	8	34	67	81	122	102
Hawke's Bay	2.1	14	3	4	4	23	14	69	79	91	93	120	95
Dominion..	1.7	13	25	9	24	31	31	47	20	85	77	1,178	1,744
<i>Crested Dogstail.</i>													
Southern ..	2.3	14	11	26	11	40	24	20	54	79	87	713	563
Sandon ..	0.3	29	9	9	3	22	28	40	60	80	86	67	58
Dominion..	..	17	15	23	11	39	24	21	50	79	84	874	768
<i>Cocksfoot.</i>													
Akaroa ..	4.4	77	83	16	15	6	2	1	..	64	62	70	75
Danish ..	0.5	7	21	42	43	50	34	1	2	73	76	127	126
Plains ..	3.9	46	15	9	40	45	34	..	11	72	79	11	35
Dominion..	4.6	48	43	27	27	23	27	2	3	69	69	..	433
<i>Chewings Fescue.</i>													
Southern ..	0.9	36	10	15	10	25	38	24	42	73	82	431	554

Reference to Table 5 shows that the percentage of samples of Southern rye-grass germinating in the 91-100 group was only 5, while in 1925 more than half germinated over 90. The position for dogstail and Chewings fescue is reversed, the increase in high-germination samples being particularly noticeable. The germination of Canterbury rye-grass was depressed for the same reason—humid conditions. Southern dogstail experienced a late frost while in the milk stage, and the crop was greatly reduced; high prices have ruled in consequence. The late season was a good one for brown-top—particularly Southern seed, 50 per cent. of which germinated over 90 per cent., and twenty per cent. 80 to 90 per cent.

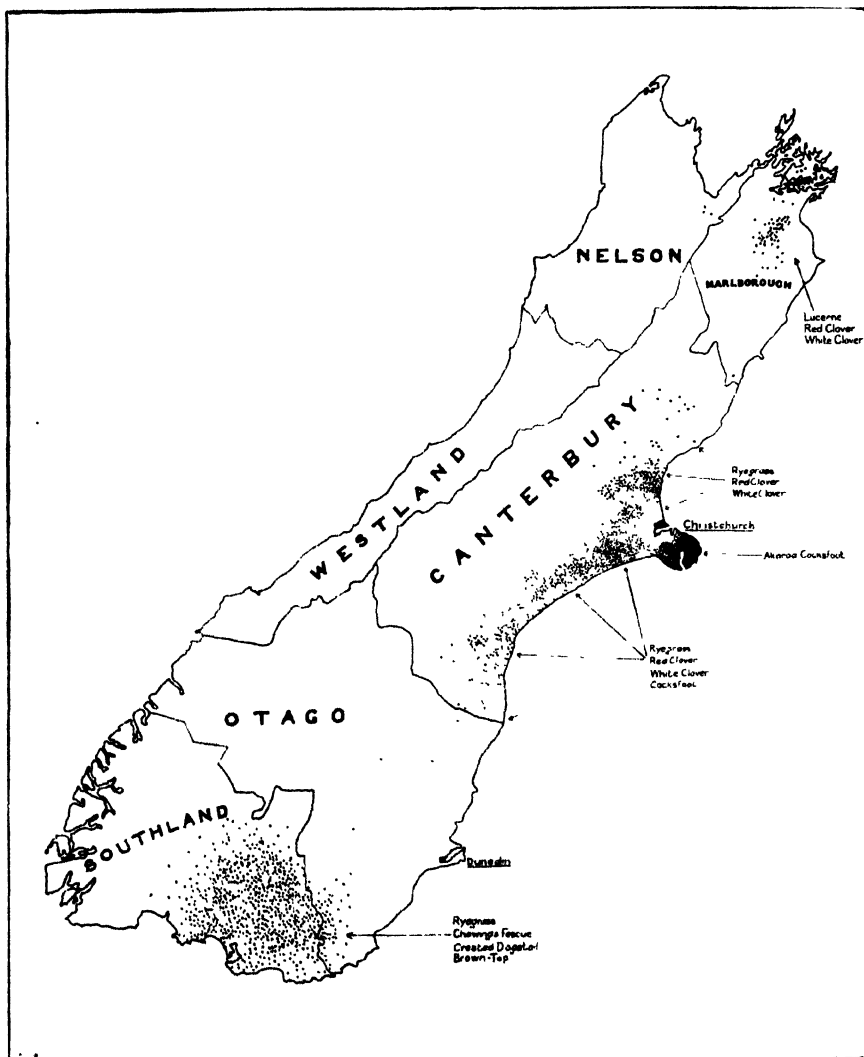


FIG. 1. GRASS- AND CLOVER-SEED PRODUCTION IN THE SOUTH ISLAND.

Each dot represents 5 tons of farmers' dressed seed.

The average germination percentages of species not mentioned in Tables 4 and 5 are as follows: Red-top, 75; florin, 70; Yorkshire fog, 78; *Poa trivialis*, 74; prairie-grass, 62; sheep's fescue, 20; rats-tail, 79; Indian doob, 96.

Table 6.—Occurrence of Main Impurities of Principal Grasses, Percentages of Seed Impurity, and Number of Impurities noted in each Species, 1926.

NOTE.—The figures placed after each impurity are the percentages of samples in which the impurity occurred in the species at the head of the column—i.e., hair-grass occurred in 63 per cent. of the samples of perennial rye-grass examined.

Impurities.	Perennial Rye-grass.	Italian Rye-grass.	Cocksfoot.	Crested Dogtail.	Chewings Fescue.	Brown-top.	Timothy.	<i>Poa</i> <i>pratensis</i> .	<i>Danthonia</i> .
Total average percentage ..	1.7	0.3	4.6	2.3	0.9	2.0	0.6	0.7	12.6
<i>Useful Seeds.</i>									
Average percentage ..	1.3	0.1	3.7	2.0	0.6	1.0	0.3	0.2	7.7
Perennial rye-grass ..	..	*	95	87	91	15	19	15	65
Italian rye-grass ..	74	..	2	2	..	1	4	..	24
Cocksfoot ..	31	6	..	48	35	2	7	10	17
Crested dogtail ..	25	10	8	..	39	15	7	..	29
Chewings fescue ..	5	..	3	30	..	3	..	..	17
<i>Agrostis</i> sp. ..	1	..	7	21	8	..	46	6	34
Timothy ..	2	..	7	4	2	4	..	80	13
<i>Poa pratensis</i> ..	5	3	60	54	9	3	58	..	47
<i>Danthonia</i> sp. ..	2	..	4	1	2	4	..	..	..
Yorkshire fog ..	21	3	72	88	76	20	15	5	54
White clover ..	19	10	17	21	12	14	69	70	8
Alsike ..	10	..	2	3	2	2	92	..	4
Cow-grass ..	3	3	14	2	1	..	46	12	4
English trefoil ..	2	2	15	1	..	1	..	10	..
<i>Lotus</i> spp. ..	..	..	..	1	..	49	5	4	8
Suckling-clover ..	34	44	4	45	10	29	12	5	46
Total number of useful species noted	20	9	21	16	15	24	18	11	21
<i>Weed-seeds.</i>									
Average percentage ..	0.4	0.2	0.9	0.3	0.3	1.0	0.3	0.5	4.9
Hair-grass ..	63	41	13	24	51	20	7	..	75
Goose-grass ..	71	50	68	..	10	..	..	..	38
Catsear ..	25	10	36	55	82	49	..	12	47
Sweet vernal ..	10	6	14	26	47	23	4	..	71
Rib-grass ..	23	28	44	16	4	20	27	16	38
Sorrel ..	28	19	21	16	27	22	61	36	29
Curled dock ..	2	..	10	1	1	2	4	15	4
Californian thistle ..	3	..	..	40	4	3	15	..	..
Hawkweed ..	2	..	17	41	1	15	7	..	4
Ergot sclerotia ..	24	3	20	25	10	86	57	45	5
Ox-eye daisy ..	..	..	2	..	..	6	4	..	4
<i>Poa annua</i> ..	..	..	..	9	..	..	..	..	..
Chickweed ..	2	3	2	15	9	61	15	41	8
Toad-rush ..	..	..	2	1	4	78	..	..	..
Hawkbit ..	6	3	3	15	1	6	4	..	..
Total number of weed species noted	34	16	37	39	31	44	33	27	27

* Italian rye-grass with the distinguishing awn broken off is inseparable from perennial rye-grass in routine analyses.

Purity.—Table 6 shows the average percentages of seed impurities—both useful and weed seeds—together with the percentages of samples in which the various impurities occurred, and the total number of species noted. Cocksfoot, dogstail, danthonia, and meadow-foxtail exceed 2 per cent. in total impurity, but only in the two last-named does the weed impurity exceed 1 per cent. In all these species the useful impurity was an excess of rye-grass, and in the case of danthonia the high weed-content consisted mainly of hair-grass.

Noxious impurities: Californian thistle was noted in 40 per cent. of the samples of dogstail, at the rate of 50 to 15,000 seeds per pound; in rye-grass, Chewings fescue, and brown-top in small quantities only. Ox-eye daisy occurred in Danish cocksfoot and in brown-top at the rate of 100 to 7,000 seeds per pound. A few samples of brown-top contained dodder and ragwort seed in small quantities.

Brown-top samples contained on the average 33 per cent. of chaff; Southern seed contained rarely more than 5 per cent. A few special analyses for the detection of red-top in brown-top were made, and red-top, when present, ranged from 1 per cent. to 80 per cent. of the sample. Apparently most brown-top seed is liable to red-top contamination, but usually only in very small amounts.

CLOVERS AND RELATED SPECIES.

Germination.—The average purity and germination, &c., of the main clovers and related species are shown in Table 7. There is nothing specially noteworthy except the unusually high percentage of hard seeds in lucerne. Up to the end of 1926 one-half of the hard seeds in the legumes has been allowed as viable and included in the final germination percentage. From 1st January, 1927, the percentage of germination and percentage of hard seed are being given separately, and no portion of the hard seed allowed as viable. In consequence the germination percentages reported will in most cases be lower.

Table 7.—Average Germination and Purity of the Main Clovers and Related Species, 1926.

(Average germination for 1925 in parentheses after 1926 figures in second column.)

Species.	Percentage of Germination.			Percentage of Samples germinating between				Seed Impurities				Average Percentage of Hard Seeds.	
	Average	Highest.	Lowest	Number of Samples noted				Average Percentage.		Useful	Weed		
				0-70.	71-80	81-90	91-100	Useful	Weed		Useful		Weed
White clover ..	89 (89)	100	9	3	7	38	52	24	54	1.8	1.5	11.5	
Alsike ..	86 (88)	100	25	10	10	25	55	13	20	2.8	0.2	3.4	
Cow-grass ..	90 (88)	100	8	5	2	15	78	22	38	0.1	0.2	5.0	
Lucerne ..	83 (88)	100	..	10	25	37	28	7	13	0.1	0.1	19.4	
English trefoil ..	77 (79)	98	16	19	23	39	19	4	6	0.1	0.1	4.5	
Crimson clover ..	94 (95)	100	69	5	12	..	83	10	11	0.1	0.1	..	
Lotus major ..	78 (75)	97	27	13	33	36	18	18	29	8.8	0.1	20.6	
Subterranean clover	91 (77)	99	71	..	12	18	70	15	14	0.1	0.1	12.9	
Suckling-clover ..	77 (77)	84	41	46	27	27	..	9	18	24.5	1.7	40.0	

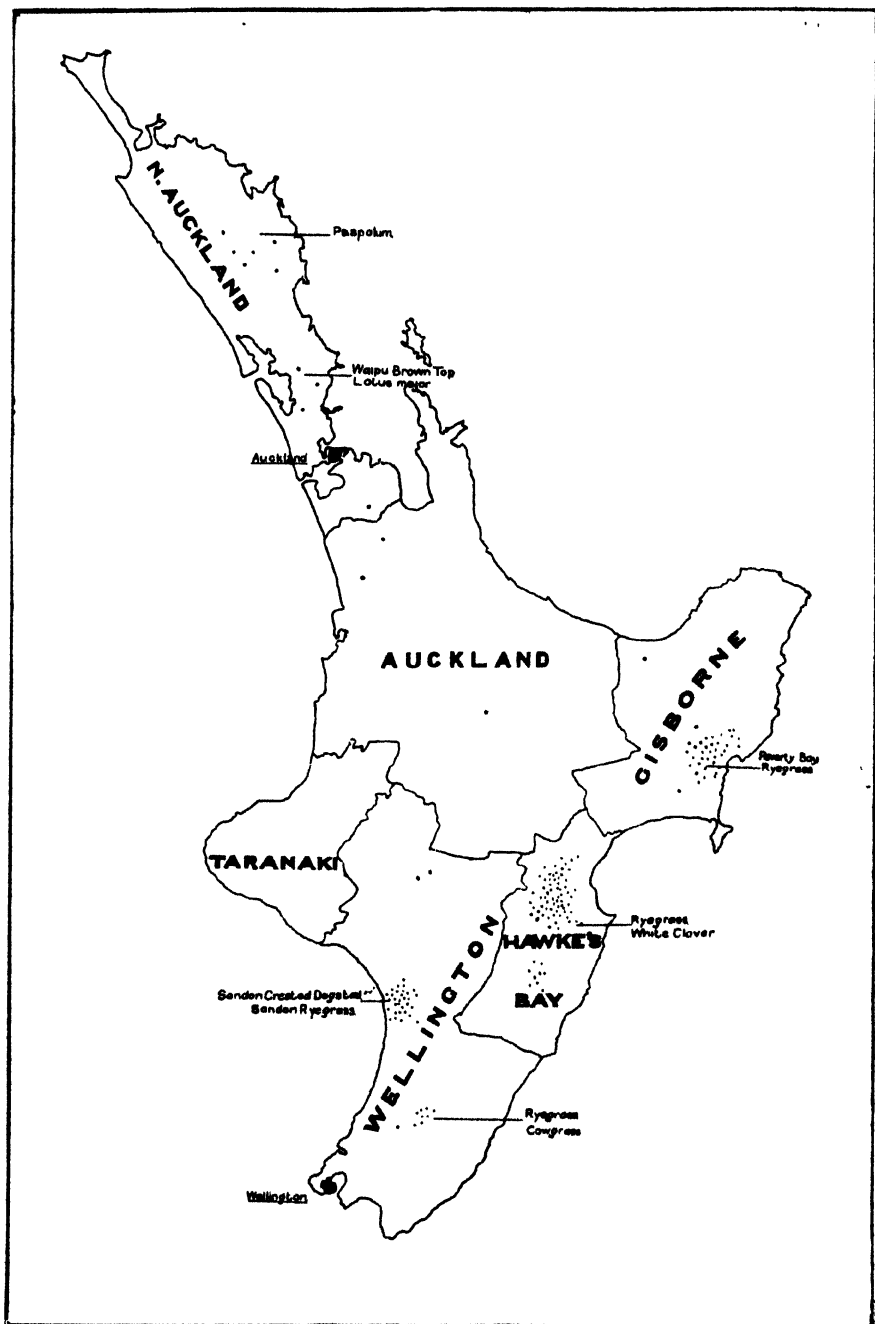


FIG. 2. GRASS- AND CLOVER-SEED PRODUCTION IN THE NORTH ISLAND.

Each dot represents 5 tons of farmers' dressed seed.

The average germination of clovers, &c., not included in the table is as follows: *Lotus hispidus* (*angustissimus*), 62 per cent.; *Lotus corniculatus*, 75 per cent.; Strawberry clover, 88 per cent

Purity.—Table 7 shows the average seed-impurity percentage divided into useful and weed seeds, also number of species of impurity noted. White clover, alsike, *Lotus major*, and suckling-clover show over 2 per cent. of total impurity. By far the greater proportion of these total percentages are made up of useful seed, and only in white clover and suckling-clover does the amount of weed impurity exceed 1 per cent.

Noxious impurities: Dodder occurred in two samples of cow-grass in small amounts; in 5 per cent. of the white-clover samples, from twenty to one hundred seeds per pound; in 27 per cent. of the *Lotus-major* samples, from forty to 6,500 seeds per pound. The increasing occurrence of dodder in Waipu brown-top and in *Lotus* spp. indicates that this weed is spreading fairly rapidly in the Northern areas, and growers would be well advised to clear it when economically possible. Ox-eye daisy was noted in two samples of alsike only. Californian thistle was noted in 14 per cent. of alsike, one sample of white clover, and two of cow-grass—all at about twenty to thirty seeds per pound. Ragwort was noted in one sample of Southern *Lotus major*.

ROOTS AND CRUCIFEROUS FORAGES.

The average germination figures for this class are given in the following table:—

Table 8.—Average Germination of Roots and Cruciferous Forages, 1926.

(Average germination for 1925 in parentheses after 1926 figures in second column.)

Species.	Percentage of Germination.			Percentage of Samples germinating between						
	Average.	Highest.	Lowest.	0-50	51-60.	61-70.	71-80.	81-90.	91-100.	
Turnip ..	88 (87)	100	31	1	2	4	12	32	49	
Swede ..	83 (84)	100	10	3	4	7	17	34	35	
Rape ..	87 (89)	100	18	..	1	3	5	24	67	
Kale ..	82 (86)	97	13	5	3	9	23	31	29	
Chou moellier	82 (87)	98	29	1	3	8	20	35	33	
Mangold ..	78 (74)	97	39	3	6	15	24	39	13	
Carrot ..	65 (69)	91	13	15	19	24	21	20	1	

CEREALS AND MISCELLANEOUS FORAGES, ETC.

Average germination percentages of these seeds were as follows: Oats, 88; wheat, 86; barley, 85; rye-corn, 72; maize, 85; Japanese millet, 91; Sudan grass, 82; sorghum, 70.

Other percentages were: Peas, 96; tares, 96; vetches, 86.

VEGETABLE-SEEDS.

The average germination percentages of vegetable-seeds tested were as follows: Beet, 78; beans, 95; cabbage, 78; cauliflower, 85; celery, 78; carrot, 65; cucumber, 94; cress, 99; leek, 52; lettuce, 94;

melon, 82; mustard, 92; onion, 75; parsley, 60; parsnip, 61; pumpkin, 90; radish, 80; rhubarb, 51; spinach, 57; squash, 97.

Acknowledgment is made of the computation of the figures in this record by Mr. W. J. Cooch and Miss E. Green, of the Seed Station staff.

LIMING AND TOP-DRESSING OF PASTURE AT WINTON EXPERIMENTAL FARM.

RESULTS FOR 1926.

R. MCGILLIVRAY, F.L.S., Instructor in Agriculture, Invercargill.

THE third year's detailed investigation of the pasture known as Block 3, at the Winton Experimental and Demonstration Farm, was carried out on 20th December, 1926. Throughout the past year the block was kept under very close observation. Growth continued right through the winter, and the block was stocked at the rate of six hoggets per acre at various times during winter and early spring. The basic-slag plots gave a better growth and were frequented by the sheep to a greater extent than were the other plots. In the latter part of August and up till about the middle of September the basic-slag plots were very distinct, and the exact boundaries were discernible without any guidance from the pegs marking the various plots.

The block was closed up for five weeks, and, as the weights recorded indicate, the growth was dense and a large quantity of hay was produced. The top-dressing was carried out in June, on exactly similar lines to those detailed in the previous reports in connection with work on this block. The pasture, laid down in 1920, consists of perennial rye-grass and white clover, with suckling-clover in places. It is improving with age, as pastures treated in a rational manner generally do. The stocking during the past year was very heavy, and the amount of animal-manure deposited on the pasture correspondingly great, but by means of harrowing no difficulty was experienced in keeping the pasturage in good, clean condition.

For investigating the effects of the various treatments ten weighings were taken in each plot (see diagram), commencing at 1A, and the work was completed with the weighing of plot 10E. In each plot an outside and inside (next control) weighing was taken throughout the block. The cutting was done with a two-horse mower, and the area weighed in each case was 33 ft. by 4 ft. All samples of herbage taken for chemical and botanical analysis were air-dried under cover. No great variation was found in the dry weights under the different manurial treatments, but where neither lime nor fertilizer had been applied the loss of weight on drying was nearly 9 per cent. greater than was the case where the pasturage was grown on the limed and top-dressed plots.

Following is a lay-out diagram of the block, giving the green weights of herbage for the plot cuttings:—

	1.8 Tons Carbonate of Lime. A.	3.6 Tons Carbonate of Lime. B.	No Lime. C.	2 Tons Burnt Lime. D.	1 Ton Burnt Lime. E.	Totals.	
Plot 1 ..	lb. 49 49½	lb. 54 54½	lb. 49 52	lb. 49 50½	lb. 45½ 48	501	Basic slag.
Plot 2 ..	39 40	41 42	41 44	39½ 39	38½ 38	402	Control.
Plot 3 ..	50 48	52 54	58 54	48 52	45 46	507	Basic slag.
Plot 4 ..	41 40	44 44	41 42	40½ 41	40½ 39	419	Control.
Plot 5 ..	50½ 61	50½ 56	49½ 51½	50 49½	47 45½	507	Basic slag.
Plot 6 ..	47½ 50	46 45	47 49	45 47	39½ 40	450	Nauru phosphate.
Plot 7 ..	42 44	40 42	40 41	37½ 40	40½ 42	415	Control.
Plot 8 ..	46 45	33½ 40½	46 46	39½ 46	42½ 44	427	Nauru phosphate.
Plot 9 ..	40 42	40 32	46 45	36½ 35	35 28½	380	Control.
Plot 10 ..	32½ 37	30½ 33	44 45	32 29½	31 28½	343	Nauru phosphate.

In the following table are set out the approximate average green weights of the various manured and control subdivisions under various lime treatments:—

Table 1.

	lb
Subdivision A : 1.8 tons carbonate of lime plus 3 cwt. basic slag ..	104.0
" B : 3.6 tons carbonate of lime plus 3 cwt. basic slag ..	107.0
" C : No lime ; 3 cwt. basic slag ..	104.6
" D : 2 tons burnt lime plus 3 cwt. basic slag ..	99.0
" E : 1 ton burnt lime plus 3 cwt. basic slag ..	92.3
Subdivision A : 1.8 tons carbonate of lime plus 3 cwt. Nauru phosphate ..	86.0
" B : 3.6 tons carbonate of lime plus 3 cwt. Nauru phosphate ..	76.0
" C : No lime ; 3 cwt. Nauru phosphate ..	92.3
" D : 2 tons burnt lime plus 3 cwt. Nauru phosphate ..	79.0
" E : 1 ton burnt lime plus 3 cwt. Nauru phosphate ..	75.0
Subdivision A : 1.8 tons carbonate of lime—control ..	83.5
" B : 3.6 tons carbonate of lime—control ..	81.2
" C : No lime—control ..	84.5
" D : 2 tons burnt lime—control ..	77.2
" E : 1 ton burnt lime—control ..	74.7

The weights per plot under the manurial scheme are shown in Table 2.

Table 2.

Basic slag—					Totals. lb.	Average. lb.
Plot 1	501	505.0
Plot 2	..	..	..	..	507
Plot 3	..	..	..	..	507
Nauru rock phosphate—						
Plot 6	456	408.6
Plot 8	..	..	..	..	427
Plot 10	..	..	..	..	343
Controls—						
Plot 2	402	404.0
Plot 4	..	..	..	..	419
Plot 7	..	..	..	..	415
Plot 9	..	..	..	..	380

BOTANICAL ANALYSIS.

A botanical analysis was made of representative dry samples of the pasturage from each of the manurial blocks, and also of the controls on Subdivision C (Plots 2, 4, 7, and 9). Results are as follows:—

Table 3.

Blocks and Plots.	Grasses.	Clovers.	Other Plants (Weeds).	Blocks and Plots.	Grasses.	Clovers.	Other Plants (Weeds).
	Per Cent.	Per Cent.	Per Cent.		Per Cent.	Per Cent.	Per Cent.
A, 1, 3, 5	77.07	16.12	6.81	B, 6, 8, 10	80.45	12.80	6.75
B, 1, 3, 5	75.50	18.40	6.10	C, 6, 8, 10	81.60	11.60	7.80
C, 1, 3, 5	80.90	12.10	7.00	D, 6, 8, 10	81.33	12.05	6.62
D, 1, 3, 5	77.70	15.80	6.70	E, 6, 8, 10	81.27	12.00	6.73
E, 1, 3, 5	78.20	15.20	6.60	C, 2, 4, 7, 9	82.82	9.08	8.10
A, 6, 8, 10	80.85	12.45	6.70				

The analysis reveals some interesting information in connection with the clover content in the pasturage under different manurial and lime treatments. It was noted in the 1925 investigation that the clover content was lower in plots D and E, dressed with burnt lime, than was the case where equivalent dressings of carbonate of lime had been applied in plots A and B. The indications of 1925 were more apparent in the year here recorded (1926), and there is now every indication that the lime-supply in the top soil is about exhausted where burnt lime was applied in 1920. The average clover content as ascertained by analysis is as follows:—

		Carbonate of Lime. Per Cent.	Burnt Lime. Per Cent.
Basic slag	..	17.26	15.50
Nauru phosphate	..	12.62	12.02

On the plots treated with Nauru rock phosphate there has been a considerable improvement in the growth of clovers when this season's growth is compared with that of the two previous years. It would appear that an appreciable amount of the phosphate applied in previous years is now becoming available. In the two previous seasons the growth of clover was considerably earlier than it was this year, but notwithstanding this fact the clover content of the Nauru phosphate plots shows a satisfactory improvement. The plots dressed with high-grade basic slag have shown a wonderful improvement. In 1925 the highest clover content of the pasturage in any basic-slag subdivision was 12.10 per cent., while this year the same subdivision showed 18.40 per cent. of clovers.

SEASONAL NOTES.

THE FARM.

AUTUMN TILLAGE.

EVERY opportunity should now be taken on arable farms to push on with preparatory tillage for autumn- and early-winter-sown crops. Satisfactory tilth is necessary for all cereals, but for autumn-sown crops in particular the fine soil should be below and the small clods on the surface. Such a condition is most effectively brought about by the use of the tine cultivator. This so-called clod-mulch is the most effective means of keeping the surface open during winter rains, and enables spring cultivation to be more easily performed. Early preparation allows a certain amount of subsurface consolidation, and this condition is essential to enable moisture to rise to the surface by capillarity.

Where winter fallowing is commonly practised or desired for any special reason, the longer the ground is turned up to the weather the better heart will it be in during the following season. The winter fallowing assists in the complete decay of stubble and weeds left from the preceding season's crop. Where a winter fallow is intended, ploughing should be done at a fair depth on the heavier soils. In order that a rough surface may be exposed, the plough should be set so that the furrow slice is turned as much as possible on edge. Heavy types of soils are generally much benefited by a fallow, but volcanic and other light soils should not be allowed to lie in fallow during a long wet period, as considerable leaching takes place. On this class of land it is advisable to sow a cereal or catch crop for feeding off.

April is a good time for sowing oats, particularly Algerians. They get well established before the wet season sets in, provide one or more good late winter or spring feedings, and are ready to harvest from the middle to the end of December, being usually saved before rust infestation develops. Pickling of seed for smut-control should not be neglected; the formalin treatment is recommended. Malting-barley, which comes specially well after peas or clover, may also be sown during the coming month. Most of the wheat in Canterbury is sown later, in May and June, but preparation of the land should be well forward in April.

TOP-DRESSING AND LIMING OF GRASSLAND.

The recent heavy reduction in the price of fertilizers—especially locally manufactured phosphates—is acting as a great stimulus for autumn top-dressing this year. Many farmers, especially in the North, are in the habit of top-dressing their pastures in March or April with the object of producing late feed, and there has been a tendency of recent years to regard top-dressing as a substitute for forage crops. While it can never eliminate the necessity for providing auxiliary forage, autumn top-dressing certainly does stimulate growth during late autumn and early spring, and thus economizes supplementary feed—a valuable feature in seasons such as the present, when roots will no doubt be scarce in many districts.

Phosphates are still the first essentials on most New Zealand soils. They are best supplied in the form of basic slag, super, basic super,

and super and Nauru rock phosphate—half and half. Slag gives excellent results in most places, but when the extra cost per ton as compared with super, basic super, and rock phosphate is considered, the latter may well be given preference. Super will give the quickest returns, but the half-super half-Nauru mixture, or basic super, are likely to have a better building effect on the pastures. From 3 cwt. to 4 cwt. per acre is a good dressing where it is being applied for the first time. Where the land has already been top-dressed during the last two or three years, 1 cwt. less per acre should prove satisfactory.

Autumn is the best period for dealing with top-dressing work on hill country, making the best use of fine weather. Later, when the hills become wet and slippery, great difficulty is often experienced in getting the material on to the ground, and the costs of applying are materially increased. A highly concentrated phosphate such as super has obvious advantages for hill-country use, in respect to cost of transport by sledge or packhorse.

April and May are very suitable months for liming, the subsequent winter rains washing the ground limestone into the soil and causing it to gradually dissolve. Lime should be applied as a top-dressing and not be ploughed under. The tendency is for lime, once dissolved, to be washed down through the soil, and for this reason it should be incorporated with the surface and left there during winter. In some districts lime alone may not always give a satisfactory return for money invested, but in combination with super applied in the spring it rarely fails to give profitable results. Moreover, super sometimes fails to give returns unless in combination with lime. The most surely profitable use of lime, therefore, is in combination with super, and this is equally true with both pasture and lucerne. Results should not be expected too soon from lime under dry climatic conditions. In some parts of the Marlborough district, for example, it has taken as long as two years to act.

The importance of autumn harrowing of old pastures is now well recognized. It is quite optional for this operation to be carried out before or after top-dressing. As soon as autumn rains have softened the surface the tripods can be used with advantage.

PREPARATION FOR NEXT SEASON'S MANGOLD CROP.

In various districts mangolds are still comparatively neglected by dairy-farmers. When it is considered that an acre of mangolds is capable of producing 60 to 70 tons and more of feed, the labour and expense involved by the crop do not amount to very much per ton. At the rate of 40 lb. a day per head, together with 20 lb. of hay, a 60-ton crop will feed a herd of forty cows for about three months.

Mangolds do best on rich deep soils of an alluvial nature well supplied with vegetable matter, but with extra manuring and thorough cultivation they will produce a satisfactory crop on various types of land. Volcanic soils generally are quite suitable.

The cultivation both before and after the mangold crop is planted is quite as important as the amount and kind of manure used. It has been found that mangolds do better on a soil in good heart which has already been cropped once after grass than they do as a first crop on lea land. This is a result of the extra cultivation. Again,

mangolds can be grown successfully after mangolds or after potatoes. Early and deep ploughing is essential, and on heavy soils the use of the subsoiler is advisable. When grown after grass the ploughing must be done in the autumn to allow of the sod rotting sufficiently. If left till early spring, skim-ploughing followed by deep ploughing or a thorough disking of the grass-sod before ploughing is necessary. Otherwise the sod when turned under prevents the soil-water rising from below, with the result that the first dry spell is apt to stop all growth. Any well-rotted stable manure available should be applied before the land is ploughed.

THE MAIN POTATO CROP.

The main potato crop will be nearing maturity towards the end of this month and beginning of April, but harvesting should not be carried out until the haulms are properly ripened off, otherwise the keeping-quality will be impaired. The land should be dry at time of lifting; if lifted wet, trouble is frequently experienced from rotting of tubers. It is advisable to store potatoes intended for table use in an airy, dimly lighted building. For seed purposes a well-lighted place is desirable. Indoor storing enables the potatoes to be readily picked over from time to time in bad weather during winter.

RED-CLOVER ESTABLISHMENT.

Red clover, grown for the main purpose of seed-production, may either be sown with an oat crop in autumn or in the early spring just before the oats are harrowed. In the latter case the harrowing serves the double purpose of covering the clover-seed and cultivating the cereal crop. Red clover stools better after oats than after barley and wheat. Where it can be avoided, it is preferable not to sow red clover with barley and wheat, as these crops are frequently too strong to allow of the clover making vigorous growth. If such combination cannot be avoided, however, the clover should be sown in the spring. In this case the cereal crop is harvested before the clover is badly weakened or killed. From 4 lb. to 6 lb. of red-clover seed per acre provides an ample seeding.

MISCELLANEOUS.

Established lucerne-fields will greatly benefit by a top-dressing of lime at this time of the year—say, from 10 cwt. to 20 cwt. per acre—to be followed by a good dressing of super in the spring.

If not already completed, the sowing of permanent pasture may be continued in April. The danger of late sowing lies in the damage to crowns during winter frosts, and rather more clover should be sown, with perhaps some oats as a light cover-crop.

The drainage-systems on farms should now be examined. It frequently happens that the rank summer growth to a large extent blocks the outlets. As the ground becomes softened with autumn rains the drainage of any low-lying areas not yet dealt with should be pushed ahead. Make sure of a good outlet—whether it be by Dutch well, creeks, or watercourses—otherwise much labour will be wasted. Plan the scheme first, and do not expect a few drains to effectively drain a large area where the soil type or fall is unfavourable.

There are still considerable areas in the South laid down to pasture with a cereal crop. This is not a very desirable practice, and frequently the grass is very weak at the time the cereal is cut. A top-dressing of super as soon as the field is cleared makes a wonderful difference, and generally ensures a successful establishment of both grasses and clovers.

—*Fields Division.*

THE ORCHARD.

SPRAYING.

TREES infested with woolly aphis, red-mite, or apple leaf-hopper will require to be sprayed again in order to reduce the infection as much as possible before winter. The application of oil (1 in 60) as soon as the fruit has been harvested from affected varieties has given good results. In localities where the leaf-roller caterpillar is troublesome late varieties of apples should be resprayed with arsenate of lead. It is recommended, in order to prevent a late affection of black-spot on the later-maturing varieties of apples and pears subject to this disease, that the trees should be resprayed as soon as it makes its appearance. Where brown-rot has been in evidence, gather and destroy all mummified fruits and all dead twigs about the trees. For gummosis cut out the gum-pockets and paint the wounds.

The present spraying season is practically at a close, and the time has arrived for fruitgrowers to consider the results obtained in the control of pests and diseases in their respective orchards. A thorough investigation should be made into the results obtained from the various spraying compounds used, together with the methods employed in their application, with the object of determining the factors contributing to success or to unsatisfactory results, as the case may be. The grower comparing the analysis of the present season with the results of former years will be in a position to intelligently amend his programme and eliminate any weakness found in it. Many orchardists do not keep a record of the sprays applied to the trees, or even a note of the actual results obtained. It is in every grower's own interest that such a record should be kept.

HARVESTING AND STORAGE OF FRUIT.

During the coming weeks this work will be engaging most of the orchardist's attention. Every endeavour should be made to pick the fruit as soon as it is ready. It is again necessary to emphasize the necessity for careful handling, as the percentage of damaged fruits arriving on the markets is much higher than it should be.

The result of careless handling is frequently not felt so severely during the earlier part of the season, when the fruit is sold immediately after it is picked, as it is with the later varieties which are usually held for a time. Fruit intended for storage should be most carefully handled and graded, and all bruised fruits, and fruits with a broken skin or with other blemishes detrimental to quality and appearance, should be rejected for cold storage. The graded fruit should be placed in the cold store as soon as possible after picking.

A little trouble in the way of placing the various sizes and grades of fruit in the store so that they may be readily got at will save much inconvenience and additional handling when the time arrives for marketing the fruit. It is the practice of some growers to wrap the fruit when it is being packed for storage for the local market, but this is not generally recommended. It frequently happens that after a period of storage the fruit requires to be sorted before being placed on the market, and this can be done much more quickly with unwrapped fruit. It is better practice to wrap the fruit when it is taken from storage.

PLANTING.

Very careful consideration should be given to the selection of varieties for planting. The field of choice is a large one. The pioneers of the industry, by careful observation and by trying new varieties, often at considerable loss to themselves, have reduced the number of varieties that need be considered as being suitable to our requirements to under a hundred. It must ever be borne in mind that different varieties of fruit thrive better in some soils and climates than they do in others, and in making a selection the adaptability of a variety to the locality in regard to hardiness, productiveness, and the development and quality to which the fruit will attain have to be considered. The requirements of the markets for which it is intended to cater, and the carrying-qualities of the fruit, also require consideration. The fact that some varieties are inclined to be shy bearers when not closely associated with a certain other variety should not be overlooked. The planter should aim at planting a sufficient number of trees of each variety, so as to ensure a reasonable quantity of fruit of each variety being available for market purposes. The mistake of planting too many varieties should be avoided. The trees should be ordered early.

—W. K. Dallas, *Orchard Instructor, Dunedin.*

Citrus-culture.

The period of autumn rainfall is the most desirable season for sowing green crops in the citrus grove, to be ploughed in later. Peas, vetches, lupins, and horse-beans are all desirable crops to grow, according as to how they succeed in the locality. The most essential feature to ensure a good stand is prompt sowing coinciding with the early rains while the land is still warm. Later, when the land becomes saturated, the soil is much colder, with both germination and growth slower.

Prior to sowing, the land should be so worked as to provide a ready get-away for surplus winter rains. Unless the land is properly graded with this object, hollows may be left which, while hardly noticeable now, collect water during winter, often unnoticed among the green growth but causing much root-damage.

A dressing of $\frac{1}{2}$ ton of super per acre may with advantage be worked in with the seed, but highly nitrogenous manures should be avoided at this season, as it is undesirable to force growth so late in the year, which would still be quite soft and easily damaged during even light frosts in winter.

Now is the time to cut away from the trees all lower branches or twigs to at least 18 in. clear of the ground. Clean away all refuse

from under trees, and dress the soil-surface directly under the spread of the tree with pulverized sulphate of iron, $\frac{1}{2}$ lb. to the square yard. These preliminary precautions against an attack of citrus brown-rot are very necessary if full control is to be secured later, while the application of iron also does much to prevent chlorosis and maintain a healthy deep-green tone of foliage.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

MANAGEMENT OF THE PULLETS.

PROPER management of the pullets will still be the most important item in the poultry-keeper's work during the next few weeks, and the greatest care must be taken to keep them off the moult. Now that the young birds have begun to lay, or are on the point of doing so, they should be receiving a good supply of the best nourishing food. The morning mash may consist of one part by measure of good-grade wheatmeal to two parts of bran; or, where a good quality of pollard is available, two of this to one of bran. In either case the mash should be moistened with skim-milk, meat-soup, or boiling water, and mixed to a crumbly condition. Cold water will do for moistening purposes where milk or soup is not available, but by using boiling water the mash is made more appetizing and consequently will be better relished by the birds.

In order to secure a good egg-yield in winter, animal food in some form is imperative. The meat ration should, where possible, be fed by itself at a regular time—say, at midday. Where meat-substitutes have to be fed, these can be sparingly supplied in the morning mash, and increased by degrees up to 8 per cent. of the entire mixture, while, in addition, some may be placed in a separate hopper and left for the birds to pick at as they desire. If ovarian disorders occur, this indicates that the ration is of a too forcing nature and that the amount of animal food should be reduced.

Equal parts of wheat, oats, and maize make a good evening meal. When it is observed that the birds are leaving any one particular grain this should be given in a reduced quantity. The birds should be fed in the house at all times, and induced to exercise as much as possible by being compelled to scratch in dry litter for their grain ration. It is a good plan to give more food at the evening meal than the birds require; then, with the grain being fed in litter, they will have something to scratch for and keep busy in the early morning when searching for the grains left from the evening meal.

Do not fail to provide as much food as the birds will eat, for it should be remembered that an egg is one of the most concentrated and richest food products known. Obviously a hen cannot be expected to lay day after day a 2 oz. product and at the same time maintain its bodily vigour if kept in a state of semi-starvation. Further, do not forget to provide an abundance of green material, also sharp gravel-grit, crushed oyster-shell, and clean water.

LEG-WEAKNESS IN HALF-GROWN COCKERELS.

Several complaints have reached me of young cockerels losing the power of their legs. This condition is often brought about by over-feeding rich foods such as meat, meat-meal, table-scraps, milk, &c., also where insufficient exercise is provided. These influences tend to force the body of a growing bird to a degree that is beyond the strength of the undeveloped legs to carry. There is here a close analogy to the hothouse plant—a rapid development but lacking in substance. Many poultry-keepers make the mistake, after selecting the most promising cockerels for future breeding purposes, of placing them in a small coop or confined quarters. Confinement is necessary in priming birds for table use, but it is most undesirable for vigorous and healthy growth. The coddled bird during its growing stage, whether male or female, seldom or never makes an ideal breeding specimen. Plenty of fresh air and natural exercise will always be the fundamental requirements for raising vigorous stock. The modern high-type layer is a more or less artificial product, but if her kind is to be reproduced in good numbers from generation to generation the demands of nature must be observed. The higher the type of bird the greater the need to provide against the weakening influences of close confinement and lack of exercise.

On the first sign of leg-weakness all forcing-food should be eliminated from the ration. In addition, where possible, the birds should be provided with a good range, preferably on clean ground. I quite realize that all poultry-keepers do not possess conditions enabling them to provide a good range and natural exercising-space for the growing stock. In such cases the next best thing is to keep the birds busy by compelling them to scratch in deep litter for their grain food, and above all to provide an abundance of green material. In the case of the light breeds, such as Leghorns, &c., leg-weakness is often accompanied in growing cockerels with falling-over combs, a condition which is always encouraged by subjecting the birds to confinement. Especially with cockerels from which it is intended to breed, a free range suggests the best assurance of healthy development. Of course, this should go hand-in-hand with sound breeding, good feeding, comfortable housing, and efficient management generally.

TUBERCULOSIS.

Now that the adult birds are finishing up an exhaustive laying season and are on the point of moulting they are just in the condition to contract disease, especially one such as tuberculosis. It is imperative, therefore, for the birds at this time to be in as good health as possible, in order that they may have the power of resistance should they come in contact with infection. Their blood should be maintained in good order. This implies a plentiful provision of green food, clean water, and grit, while a plain but wholesome diet should be supplied. In addition, the surroundings should be as sanitary as possible. If tuberculosis makes its appearance in a flock, affected birds should be killed at once and the carcasses burnt. Drastic methods of suppression are most necessary, and no time should be lost in thoroughly cleaning up the plant and removing all sources of infection, chief among which is the droppings of affected birds.

The symptoms of tuberculosis are many, but it is only the man of experience who can detect them, especially during the early stages of the disease. To the novice a wasted appearance is perhaps the plainest sign. Then the breast-bone stands out sharply from the body, and, together with the neck, becomes devoid of flesh. The comb presents a dark unhealthy appearance, diarrhoea usually accompanies the disease, and the excrement is of an unnatural colour. The bird generally limps in the right leg as the disease develops. During the latter stages it will present a listless appearance, and is disinclined to mix with the other members of the flock. When opening up a tuberculous bird the liver is usually found to be enlarged by reason of the presence of tubercle nodules scattered throughout the mass. The terms "spotted liver" and "going light" are often used to designate the condition of a bird whose liver presents this appearance. It is, however, tuberculosis and nothing else.

For this disease there is no cure; prevention is the one and only way of keeping it in check. The first step in this direction is to breed stock possessing the necessary constitutional vigour to combat the infection should a bird come into contact with it. Too much emphasis cannot be placed upon the value of plenty of fresh air in the poultry-house, while strict attention to cleanliness is of equal importance.

—F. C. Brown, *Chief Poultry Instructor.*

THE APIARY.

WINTER STORES.

A CAREFUL examination of all hives in the apiary should now be made, in order to note the amount of honey that each possesses. It is not a good policy to winter on less than 35 lb. to 40 lb. of honey, and in the warmer parts of the Dominion it is advisable to increase this amount by half. If a colony is short of that weight and is to be wintered successfully, feeding will have to be resorted to. Just in proportion to the amount of honey that is left so will the colony thrive in the spring. If it is found necessary to feed, do so, and do not delay until the cold weather sets in. Use only inside feeders, as outside feeding is dangerous. On no account feed honey unless sure that it comes from a clean source. Using honey from a diseased hive is a certain method of infecting the apiary.

A syrup made of two parts of granulated sugar to one part of water will be found excellent for replenishing the stores when such are considered to be inadequate. The syrup is prepared by heating until there remains no trace of the sugar-granules. On no account must the mixture be allowed to boil, as this will destroy the value of the food and cause dysentery among the bees. Avoid using cheap sugars or molasses: only the best white sugar of commerce should be fed. In the absence of regular feeders, empty supers may be placed over the brood-chambers, and the syrup placed in shallow pans on top of the frames.

FOUL-BROOD.

In closing down the hives for winter the combs must be carefully examined for brood disease. Where disease is detected in a bad form do not waste time in treating, but destroy the colony. In mild cases

remove the diseased combs and insert either sheets of foundation or drawn-out combs — the latter for preference. Make a note of the infected stocks for treatment in the spring, when fine weather will enable the work to be carried out successfully. Do not tinker with diseased hives in the off season, as the trouble is more likely to spread among the clean ones by robbers.

CARE OF UTENSILS.

When extracting is finished for the year care should be taken that all traces of honey are removed from the extractor, tanks, &c. Wash carefully with boiling water, and dry thoroughly. Cleanliness should be observed as a very important matter where articles of food are concerned. Cover everything carefully from dust which may accumulate during the winter months. Loose washing-covers of close texture are the best for the purpose. Give a good coating of oil to any metal parts likely to rust: this will save much trouble in the following season.

CARE OF HIVES.

Where necessary the hives should now be given a good coating of paint. Stop up all cracks, and replace faulty hives with sound ones. Pay special attention to roofs, as it is very important that the bees should come through the winter dry. It may be necessary to cover the roofs with some waterproof material. If zinc is found too expensive, a cheap substitute, such as ruberoid, may be used. Clean all bottom-boards by scraping. The simplest plan is to provide a spare bottom-board. Lift the hive on to the spare one, scrape the old board, and replace the hive. Contract entrances against robber bees and mice, the latter pest being one for which apiarists must watch during the bees' dormant season. If these precautions are followed the colonies will be ready for winter.

—E. A. Earp, *Senior Apiary Instructor.*

HORTICULTURE.

HARVESTING THE MAIN CROPS.

ALTHOUGH every month is harvest-time in horticulture, the autumn has that title in a special sense, as the larger main crops then reach maturity, and many of them are of kinds which require long storage, so that they may be available over an extended period covering the winter months when fresh supplies are not so plentiful as usual. For this reason they require a special care that they do not always get. With some of the more important crops in many countries certain grades of produce are recognized in the markets when trading, and in other instances these are demanded by law. Such standard grades have many advantages, but specially does it facilitate successful storage and market transactions, thus placing the whole business on a more secure foundation. Money is more readily advanced on such stocks, so very much greater is the security.

In this direction there is room for much improvement in our methods. It is not uncommon to see large quantities of ungraded and low-graded produce incurring the expense of storage and marketing that obviously can never be financially satisfactory, and because

the practice cannot pay one expects it to be discontinued ; but it still goes on, and the loss is apparently the price of experience. The least excusable practice is to mix good and bad together.

The time to grade a product is at the time of harvesting, so as to reduce handling and cartage to a minimum. By a careful consideration of the crop then it can be seen whether the main bulk is superior or good average. If the former, it can be graded and sold as such ; but if there is more than 50 per cent. of the lower grade it is generally graded and sold under that class name. In any case all undersized, broken, and diseased samples must be graded out ; to mix such stuff in the market grade is to lower the sample and depreciate the value much beyond any little advantage in weight. Produce in perishable condition compels a forced sale, which is a decided disadvantage to the owner. Graded produce, when given suitable storage, may be held with some confidence. It is important that the store should be clean and ample ventilation available, so that heating may be avoided, especially during the first few weeks of storage.

LAND-TREATMENT AND CROP-ROTATION.

At the other seasons of the year, as soon as one crop is harvested another is planted after a brief preparation. At the present time, with the near approach of winter months, advantage is taken to give a more thorough preparation to the land, and by dealing with different areas each winter the whole is kept in a state of fertility. The first part of the operation is to burn up the remains of the previous crop. Although if ploughed in this vegetation would form an excellent manure, too often it is affected with disease that may be readily transmitted. So frequently is this the case that the precaution of burning can rarely be omitted.

Where heavy dressings of organic manures are required and available they may be ploughed in now to advantage, or the slower-acting manures such as basic slag or blood-and-bone may be applied. Lime also may be applied now, so that its action in correcting acidity and improving the mechanical condition of the soil may be accomplished before cropping recommences. More especially does the present time afford the best opportunity for sowing a hardy green crop for ploughing under in the spring. This, as far as possible, should be of a different type from the crop immediately preceding or following it.

What treatment is given to the respective areas depends on the crops it is purposed should be planted later, and this brings one to the consideration of rotation cropping, than which nothing is more important to the grower. In the older countries centuries of experience have established in each district, according to the class of land and the crops in demand, a suitable rotation that economizes the costs of manuring, minimizes the danger of disease, and maintains the fertility of the soil. Under pressure of modern conditions, and with a virgin soil, one frequently takes the advantage to grow only the best-paying crops, which allows of little or even no rotation. But there is an end to this prodigal style of farming sooner or later, and it is a very difficult position to meet. A consistent prosperity demands that this question be studied closely in each locality and a good system of rotation arrived at.

The phase of rotation cropping being considered at present refers to vacant areas of land in market gardens at the present season and their treatment. Heavy dressings of organic manures and green crops are usually succeeded by such strong-feeding permanent crops as rhubarb and asparagus, or quicker-maturing but still gross-feeding crops as cabbage, broccoli, cauliflower, leeks, celery, and lettuce. Crops the marketable portion of which are the roots do best in a soil in which this rankness has passed off, and so usually succeed the class just mentioned. Such plants as produce fruit or seed for marketing, if grown too rankly and vigorously, defeat the end in view, as experience has proved that such a type usually flowers but sparsely, and even these flowers are unlikely to set.

These statements are generalizations, and much depends on the class of soil and the rainfall of a district. The principles stand, however, and in a good rotation is to be found the most economical way of solving the expensive problems of manuring and disease and pest control.

MANAGEMENT OF TREES AND SHRUBS FROM THE NURSERY.

Where planting of this kind has to be done to any extent it is desirable to give the order the most careful consideration, and now select and order the plants required. The supply is frequently limited—in some directions, at any rate—and if the order is postponed there is a danger of having to accept substituted varieties or indifferent quality. Much better is it, considering the permanent nature of these improvements, to order early and get just what is required.

In most instances it is also desirable to take delivery as soon as the plants are available, which will probably be about the month of May, when, if the plants are growing in boxes, they should be placed together in a handy position where they can be watered when necessary and not allowed to dry out. If the plants are in bundles and have been closely packed for some time they should be opened up in a well-ventilated shed, and allowed to air and harden for twenty-four hours or so before being taken out and heeled in. This last operation is done by opening out a trench in a piece of spare ground in friable condition, and of sufficient length and size to hold the roots. Place the plants in the trench close together but not too thickly; cover the roots well with soil, and tread it rather firm. In this way the plants will keep well—all winter, if necessary—until one is ready to put them out into a permanent position.

VEGETABLE CROPS.

The winter crops of cabbage, cauliflower, celery, &c., will soon be ready for cutting. The blanching of the main celery crop should now be completed. The top growth of the asparagus crop will require to be cut down and burnt as soon as it ripens.

During the coming month, on a piece of warm, well drained and prepared land, plant out from seed-beds sown in February the early cabbage, cauliflower, and lettuce plants for spring cutting; and towards the end of the month sow further beds of these plants for putting out in the spring. These should be main-crop varieties for cutting in early summer. For this purpose the beds are better raised and sown thinly.

—W. C. Hyde, *Horticulturist*.

THE NEW DAIRY-PRODUCE REGULATIONS.

MANUFACTURE AND EXPORT.

(Continued from February.)

Ports and Grading-stores.

54. The ports of Auckland, Gisborne, Napier, New Plymouth, Patea, Wanganui, Wellington, Lyttelton, Timaru, Dunedin, and Bluff are hereby appointed to be the only ports at which butter or cheese may lawfully be exported.

55. The buildings specified in this clause, not including any substantial additions that may be made to such buildings after the gazetting of these regulations, unless the use of such additions has been first approved, are hereby appointed to be stores for the storage, cooling, freezing, examination, and grading of butter or cheese prior to export; that is to say, the following buildings:—

The three stores of the Auckland Farmers' Freezing Company (Limited) at Auckland, Southdown, and Horotiu; the store of the Gisborne Sheep-farmers' Frozen Meat Company (Limited) at Gisborne; the store of J. J. Niven and Co. (Limited) at Port Ahuriri; the store of the Taranaki Producers' Freezing Company (Limited) at Moturoa; the store of the West Coast Refrigerating Company (Limited) at Patea; the Wanganui Cold Storage Company's store at Castlecliff; the Wellington Harbour Board's No. 27 store at Wellington; the two stores of the Co-operative Dairy Producers' Freezing Company (Limited) at Wellington; the Lyttelton Harbour Board's cold store at Lyttelton; the store of the New Zealand Farmers' Co-operative Association (Limited) at Christchurch; the store of the New Zealand Refrigerating Company (Limited) at Smithfield; the store of the Otago Dairy Producers' Co-operative Cold Storage Company (Limited) at Dunedin; the store of the Taieri and Peninsula Milk-supply Company (Limited) at Dunedin; and the store of the Southland Cool Stores (Limited) at Bluff.

56. The ports and stores named in the last two preceding clauses are in substitution for those heretofore appointed, and every Order in Council heretofore made appointing ports or stores for the said purposes is hereby revoked.

57. The owner and person in charge of any building appointed to be a store for the storage, cooling, freezing, examination, and grading of butter or cheese prior to export shall cause the following requirements to be at all times complied with: (a.) The store and its appurtenances shall be maintained in an efficient state for the purposes for which it is appointed. (b.) All butter and cheese received into the store under the provisions of these regulations shall within a reasonable time after such receipt be reduced in temperature to the extent prescribed in subparagraph (c) of this clause, and shall be held at such reduced temperature until removed from the store. (c.) The temperature of butter or cheese at the time of delivery from the store for export shall not exceed 15 or 45 degrees Fahrenheit respectively. (d.) The humidity and circulation of the air in every chamber used for storing cheese shall be so controlled as to prevent excessive shrinkage in the weight of, and to prevent undue growth of mould upon, the cheese stored in such chamber.

Submitting Butter or Cheese for Grading.

58. With regard to butter or cheese for export to any country other than the Commonwealth of Australia or the South Sea Islands the following provisions shall apply: (a.) All butter shall, by the owner thereof, be placed in one of the appointed stores, at least four clear days before shipment, for the purpose of being graded and frozen. (b.) All cheese shall, by the owner thereof, be placed in one of the appointed stores, at least four clear days before shipment, for the purpose of being graded and of having the temperature reduced if necessary.

59. All butter or cheese for export to the Commonwealth of Australia or the South Sea Islands shall by the owner thereof be placed in one of the appointed stores, at least twenty-four hours before shipment, for the purpose of being graded.

60. When forwarding any butter or cheese to a grading-store as aforesaid the owner shall at the same time notify the Grader at the port of shipment, giving full particulars of the number of packages, together with their brands,

contents, and weights, and any other particulars which the Grader has asked for. Such notification shall be in, or to the effect of, form No. 12 or form No. 13 in the Schedule hereto. Forms may be purchased from the Government Printer, Wellington.

61. Every owner of butter or cheese forwarding it to an appointed store shall make his own arrangements for storage, for the transit of the produce to and from the store, and for its shipment. He shall also, in so far as he deems desirable, make his own arrangements for its insurance and protection from loss or damage of any kind.

Grading of Butter and Cheese.

62. All butter graded under these regulations shall be placed in one of the following classes, viz.: (a) Creamery butter, which shall include all butter manufactured at any manufacturing dairy registered as a creamery and not mixed or blended into milled butter; (b) whey butter, which shall include all butter manufactured at any manufacturing dairy registered as a whey-butter factory or manufactured in the manner set out in clause 35, and in either case not mixed or blended into milled butter; (c) dairy butter, which shall include all butter manufactured at any manufacturing dairy registered as a private dairy and not mixed or blended into milled butter; or (d) milled butter, which shall include all butter mixed or blended at any manufacturing dairy registered as a packing-house.

63. All cheese graded under these regulations shall be placed in one of the following classes, viz.: (a) Full-cream factory cheese, which shall, except as hereinafter provided, include all cheese manufactured at any manufacturing dairy registered as a factory, but shall not include any cheese which contains less than 50 per centum, by weight, of milk-fat in the dry matter or has been manufactured from milk from which any milk-fat has been removed or to which any milk-solids other than milk-fat have been added; (b) modified-milk cheese, which shall, except as hereinafter provided, include all cheese manufactured at any manufacturing dairy registered as a factory and which has been manufactured from milk from which some of the milk-fat has been removed or to which any milk-solids other than milk-fat have been added, but shall not include any cheese which contains less than fifty per centum, by weight, of milk-fat in the dry matter; or (c) dairy cheese, which shall include all cheese manufactured at any manufacturing dairy registered as a private dairy.

64. In grading creamery or whey butter the following shall be the maximum points for allotment, viz.: For flavour, 50 points; for body and texture, 25 points; for colour and salting (if any), 20 points; and for finish, 5 points: total, 100 points.

65. Creamery butter shall be graded as finest, first grade, second grade, or third grade according to the following standards:—

Finest	..	..	93 points and over.
First grade	..	..	90 points and under 93 points
Second grade	..	..	80 points and under 90 points.
Third grade	..	..	Under 80 points.

66. Whey butter shall be graded as first grade, second grade, or third grade according to the following standards:—

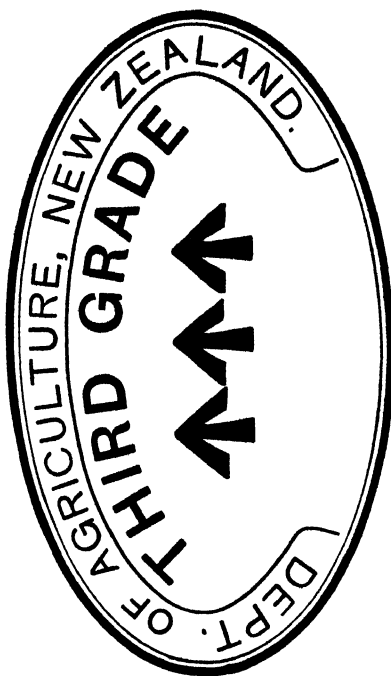
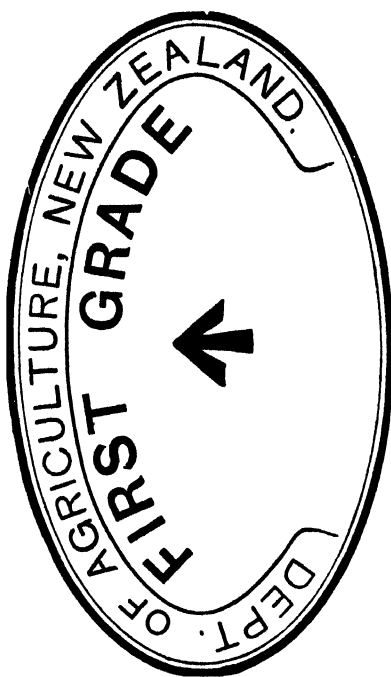
First grade	..	..	88 points and over.
Second grade	..	..	80 points and under 88 points.
Third grade	..	..	Under 80 points

67. Dairy or milled butter shall be graded as first grade, second grade, or third grade according to quality and condition.

68. In grading factory cheese the following shall be the maximum points for allotment, viz.: For flavour, 50 points; for body and texture, 30 points; for colour, 15 points; and for finish, 5 points: total, 100 points.

69. Full-cream factory cheese shall be graded as finest, first grade, second grade, or third grade according to the following standard:—

Finest	..	..	93 points and over
First grade	..	..	90 points and under 93 points.
Second grade	..	..	80 points and under 90 points.
Third grade	..	..	Under 80 points.



FORMS 14 TO 17, REGULATION 72: GRADE STAMPS.

The stamp "Graded," in lower left corner, is for second-grade butter and cheese.

70. Modified-milk cheese or dairy cheese shall be graded as first grade, second grade, or third grade according to quality and condition :

Provided that in grading modified-milk cheese or dairy cheese the Grader may, at his discretion, allot points in the manner provided by Regulation 68 hereof, and thereupon grade the cheese according to the standards set out in clause 69 hereof, save that the term "finest" shall not be used, and the term "first grade" shall be used for cheese graded as of 90 points and over.

71. (1.) In grading butter or cheese the Grader shall allot the grade upon examining, in the case of butter, one box from each churning and such further number of boxes as he deems necessary, and, in the case of cheese, one cheese from each vat and such further number of cheeses as he deems necessary.

(2.) The decision of any Grader as to the grade of any butter or cheese shall be conclusive, and no action or other proceeding shall lie against the Crown, or against any Grader, or against any other officer of the Crown, in respect of any erroneous decision of a Grader as to such grade.

72. As soon as possible after grading any butter or cheese the Grader shall stamp or cause to be stamped each package with a grade-mark in such one of the forms 14 to 17 in the Schedule hereto as is appropriate to the grade of such butter or cheese as determined in accordance with clauses 62 to 70 hereof.

73. The Grader shall also as soon as possible send to the owner of the butter or cheese a certificate of the said grade (hereinafter called a "Grader's certificate") in such one of the forms 18 to 24 in the Schedule hereto as is appropriate to the said grade.

74. Notwithstanding the provisions of clauses 72 and 73 hereof, no grade-mark shall be applied in respect of any butter which contains more than 16 per centum, by weight, of water, or less than 80 per centum, by weight, of butterfat, or in respect of any cheese of which the water-free substance consists of less than 50 per centum, by weight, of fats wholly derived from milk; nor shall any Grader's certificate be issued in respect of any such butter or cheese.

75. No person shall remove from an appointed grading-store, except for the purpose of immediately shipping it for export beyond New Zealand, any butter or cheese in respect of which a grade-mark has been applied, unless the grade-mark has been cancelled by a stamp bearing the words "Not for export."

76. No person shall export, or attempt to export, or be concerned in exporting, any butter or cheese unless it has the grade-mark stamped on the package and uncanceled, and is otherwise in accordance with the provisions of these regulations.

77. Any person who knowingly and wilfully represents or implies for any purpose whatsoever that the Grader's certificate issued in respect of any lot of butter or cheese is the certificate issued in respect of any other lot of butter or cheese commits a breach of these regulations.

78. In respect of fees for grading butter and cheese the following provisions shall apply : (a) The fee for grading butter shall be 1.24d per standard box, subject as hereinafter provided. (b.) The fee for grading cheese shall be 1.65d. per standard crate, subject as hereinafter provided. (c) (1) In the case of butter or cheese forwarded for export from a registered creamery, factory, whey-butter factory, or private dairy the fee shall be payable by the manufacturer on demand. (11.) In the case of butter or cheese not included in (1) the fee shall be payable by the owner on demand. (d.) Where it is found that the total amount paid or payable in respect of grading fees in any year ending on the 31st day of March exceeds the cost, as determined by the Minister, of the dairy-produce-grading service, including the salary and expenses of the Government Dairy produce Officer or Officers in London, the Minister may credit to the payers of fees, towards the fees payable by them during the next succeeding year, the amount paid or payable in excess of such cost as aforesaid, in the proportion in which each payer contributed towards the fees paid or payable during the period in question. (e.) Where it is found that the total amount paid or payable as aforesaid is less than the cost of the said service determined as aforesaid, the amount of such deficiency shall be deemed to be part of the cost of the said service in respect of the next succeeding year.

79. (1.) Butter or cheese shall be regraded—(a) If the owner makes a request to the Director to that effect and it is practicable for the Director to arrange for it to be complied with; or (b) if the Director is of opinion that the quality of the produce is likely to have changed since the previous grading thereof; or (c) if the

owner has removed the produce from the appointed grading-store and the produce is again forwarded for grading or shipment.

(2.) If upon regrading it is found that the grade should be altered, the Grader shall remove or cause to be removed the existing grade-marks, and shall mark or cause to be marked the package in accordance with the grade as altered; the original Grader's certificate shall be returned to the Grader to be cancelled, and the Grader shall issue a fresh certificate in accordance with the regrading.

(3.) In any case where regrading is undertaken at the instance of the Director and the grade remains unchanged no charge shall be made for the regrading or relative expenses, but in every other case of regrading the ordinary grading fees, together with any relative expenses, shall be payable by the owner in respect of each regrading.

(To be concluded.)

WEATHER RECORDS: FEBRUARY, 1927.

Dominion Meteorological Office.

GENERAL SUMMARY.

RAINFALL in February was above the average in most parts of Otago and the west-coast and northern parts of the North Island, but was deficient elsewhere. The backwardness of the early summer season was compensated for by the intensity of its later part in most districts.

The heat wave which came on about the middle of January continued until the third week in February, and some very high temperatures were recorded, particularly on the 7th, 13th, and 14th, in the east-coast districts of both Islands.

A westerly area of low pressure of moderate intensity ruled at the beginning of the month, and several minor disturbances passed south of the Dominion. One on the 22nd was followed by a cold snap, and a short but rather severe storm with a southerly gale prevailed on the 27th.

Electrical conditions were in evidence in many parts of the country about the 1st, 10th and 11th, and 26th and 27th.

During the month investigations of the upper-air currents were made at the Wigram Aerodrome, Christchurch. The ascents of twenty-one pilot balloons were followed, and records telegraphed to Wellington. Preliminary examination of these results show that although winds were from all directions at the surface, above 6,000 ft. of elevation they were from the west, and afterwards attained their greatest velocity. On one occasion the balloon was followed up to a height of 55,000 ft., while on two occasions they were lost in clouds at 3,000 ft.

RAINFALL FOR FEBRUARY, 1927, AT REPRESENTATIVE STATIONS.

Station.				Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
<i>North Island.</i>							
				Inches.		Inches.	Inches.
Kaitaia	..	..	..	5·r8	7	1·92	2·95
Russell	..	..	..	4·62	8	1·46	3·33
Whangarei	..	..	..	4·68	12	1·14	4·85
Auckland	..	..	..	5·58	10	2·02	3·06
Hamilton	..	..	..	5·10	12	1·12	2·96
Kawhia	..	..	..	5·38	12	0·85	2·40
New Plymouth	..	..	..	4·05	10	1·29	4·01
Riversdale, Inglewood	..	..	..	7·01	10	2·02	6·30
Whangamomona	..	..	..	6·23	11	1·42	4·14
Tairua	..	..	..	4·64	8	1·98	4·52
Tauranga	..	..	..	3·63	9	1·93	3·58

RAINFALL FOR FEBRUARY, 1927—continued.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average February Rainfall.
<i>North Island—continued.</i>				
	Inches.		Inches.	Inches.
Maraehako Station, Opotiki ..	6·22	11	2·12	3·48
Gisborne	4·59	10	1·23	3·63
Taupo	4·70	6	1·60	2·81
Napier	1·00	11	0·21	2·92
Maraekakaho Station, Hastings ..	1·49	9	0·71	2·52
Taihape	3·17	13	1·08	2·52
Masterton	1·58	10	0·41	2·70
Patea	2·44	12	0·71	2·33
Wanganui	0·63	4	0·28	2·49
Foxton	4·72	7	1·90	2·06
Wellington	1·82	7	0·91	3·19
<i>South Island.</i>				
Westport	0·87	11	0·20	4·37
Greymouth	2·73	10	0·57	6·13
Hokitika	3·04	9	0·86	7·31
Ross	3·13	7	0·81	8·45
Arthur's Pass	6·23	9	2·83	10·17
Okuru, Westland	7·94	10	2·28	7·92
Collingwood	3·67	10	1·41	5·63
Nelson	1·38	8	0·49	2·77
Spring Creek, Blenheim	1·80	8	0·60	2·30
Tophouse	1·58	6	0·65	4·39
Hanmer Springs	2·20	6	0·73	2·93
Highfield, Waiau	2·07	5	0·74	2·59
Gore Bay	1·66	6	0·70	3·50
Christchurch	0·80	7	0·37	1·77
Timaru	1·34	12	0·30	1·82
Lambrook Station, Fairlie	2·23	10	1·03	1·95
Benmore Station, Clearburn	1·68	5	1·22	1·23
Oamaru	1·89	7	0·65	1·68
Queenstown	1·75	7	0·70	1·76
Clyde	1·22	6	0·74	0·99
Dunedin	3·19	12	1·22	2·69
Wendon	2·52	6	1·00	1·57
Gore	2·46	8	0·80	2·56
Invercargill	3·44	15	0·66	2·85
Puysegur Point	7·94	16	2·12	4·06

—D. C. Bates, Director.

DETERIORATION OF WOOL.

INFORMATION placed before the Board of Agriculture at its last meeting indicated clearly that deterioration was taking place in some of the wool grown in New Zealand. Two contributing factors appeared to be the use of inferior rams and a tendency to dispose of the best ewe lambs as fat stock. It was resolved to bring the matter under the notice of the various breed societies, and to suggest (a) that stud flocks be more rigidly inspected, and (b) that no cull rams (among Flock-book sheep) be allowed to be sold for breeding purposes. It was further resolved to request the Department of Agriculture to instruct its Inspectors to make special efforts to induce farmers to retain their best ewe lambs for breeding purposes.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

CONTROL OF RAGWORT.

“RAGWORT,” Opotiki :—

Can you recommend a treatment to destroy a few patches of ragwort? We have been pulling these patches for the last three years before they have time to seed, placing the plants on rubbish such as logs, &c., and burning same. The trouble seems to be that the smallest fibre root left in the ground sprouts the following season.

The Live-stock Division (Noxious-weeds Inspection) :—

The question may be treated under three categories : (1) Ordinary sheep-country ; (2) land used for mixed grazing ; (3) land used exclusively for dairying purposes. For class 1 (sheep-country) we would recommend, after pulling the plants, a liberal top-dressing of the infested ground with basic super and kainit in the proportion of 4 cwt. and 1 cwt. respectively per acre. This will attract the sheep on to the ragwort patches, and they generally bring about the desired result in a couple of seasons. Ewes attack ragwort much more readily than do wethers or young sheep. Small patches aggregating an acre in a field of 50 acres or more of reasonably good pasture should not produce any serious disability to sheep depastured thereon. For class 2 (land used for mixed grazing) top-dress as for sheep-country, and if the proportion of cattle carried is greater than sheep it might be desirable to fence in the infested part in such a way that the sheep (preferably ewes) are more closely confined on the affected area. Sheep used in this way for the eradication of ragwort should be moved frequently—say, after three weeks—on to clean pasture for a similar period, when they can again be returned for a further term on the ragwort. As regards class 3, if the better-class lands are to be preserved for dairying purposes ragwort must not be allowed a place in the pastures. In the earlier stages of infestation, when the weed is confined to small patches, the matter of cultivation is worthy of consideration. In such cases it is a good plan to reverse the common practice of pulling or digging out by digging in. It will be found that this plant readily succumbs to cultivation. The surface roots, which frequently survive the pulling or digging out process, will cease to give further trouble if ploughed or dug in to a depth of 6 in. Further, the seed will not germinate if covered to a depth of 2 in. or 3 in. If odd plants and small patches of ragwort are treated with due respect and destroyed early it will save the farmer a great deal of worry and expense later.

OUTDOOR STORAGE OF APPLES.

G. H. LONEY, Wellington :—

Kindly let me know whether apples can be pitted successfully in New Zealand for keeping purposes, and, if so, the best method to adopt ; also what varieties are recommended for storing in this way.

The Horticulture Division :—

Apples cannot be pitted successfully in the usual way, as, although they keep fairly well under that treatment, the flavour is badly affected. An approximate method that is somewhat better is to make a bin in a plantation of evergreen trees or other shady place by driving in stakes and boarding up the sides or building them up with brushwood, and filling the bin with sound fruit to a height of not more than about 2 ft. or 3 ft. Pile the centre and make what protection may be necessary. Only what are known to be keeping varieties should be stored in this way, and, as any broken or decayed fruit mixed in will cause loss, success depends on only sound fruit being stored.

WIREWORMS AND THEIR CONTROL.

R., Rotorua :—

Could you please give me a brief life-history of the wireworm? What crops does it chiefly attack, and is there any way of destroying the pest—say, by a soil-fumigant?

The Fields Division :—

There are several species of wireworms, many of which are restricted in their range. The life-histories of these have not been worked out in detail in New Zealand. The following account refers in a general way to wireworms as a whole: Wireworms are the larvæ of click-beetles (Elateridae). Those species whose larvæ live underground lay their eggs under the surface of the soil about the roots of grasses. This is done by several of the species in the spring. The larvæ, on hatching, feed on roots, and may take from two to three years to fully grow when they pupate. The pupal period lasts several months. The adult click-beetles emerge from the pupæ. All pasture carries a normal wireworm population. When old-standing pasture is broken up and a crop sown—for example, cereals or potatoes—the wireworms will attack and may do some considerable damage for the first season, but the infestation diminishes considerably the longer the ground is under cultivation. Beyond thorough cultivation control is unsatisfactory. Soil-fumigation may do a little good, and the use of calcium cyanide worked into the ground during cultivation at the rate of 200 lb. to the acre has been said to have good effect. The cyanide applications should be made not later than fourteen days before a crop is sown. This treatment is practicable for comparatively small areas only.

WIND-GALL IN HORSE'S FETLOCK.

E. E. DENHAM, Auckland :—

I have a horse with a wind-gall at the fetlock. The swelling is a large one (more than half the size of a closed fist), and extends through to other side of leg. The wind-gall has been there for about three months, and may be an old trouble. The horse is lame to some extent, and the swelling hard when the animal has his weight on that leg. Will the fluid have to be drawn off, and, if that is done, will the relief be permanent?

The Live-stock Division :—

The usual treatment for severe chronic wind-galls consists of blistering the parts and, later, when the immediate effects of the blister have subsided, keeping the fetlock bandaged with dry flannel bandages. If this shows no beneficial effect within the course of two months, the only treatment likely to do good would be the evacuation of the fluid. This operation will not afford permanent relief or be likely to do any good unless performed by a skilled man, because the gall will rapidly fill up again, and unless extreme care is taken the parts will become septic, thus probably rendering the horse quite useless. As in the case of your horse the wind-gall appears to be a very large one and to be causing lameness, a good long rest would be needed after any treatment. This certainly seems to be a case for examination and treatment by a veterinary surgeon, who would be able to deal with the trouble according to its merits.

ITALIAN BEES AND SECTION HONEY.

"APIARIST," Brydone :—

Please inform me how to work sections for honey with Italian bees. I have had no trouble with Black bees, but I cannot get the Italians to start the sections.

The Horticulture Division :—

Italian bees may be induced to enter the section boxes by first adding a super of half-depth extracting-combs. The bees will enter these more readily, and get the habit of storing above. When the extracting-combs are well started, raise them and place the section boxes immediately over the brood-chamber.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 31st December, 1926, to 24th February, 1927, include the following of agricultural interest:—

No. 54485: Cheese product; A. G. W. Cutter and F. J. Schwieters, Kaponga.
 No. 54750: Butter-box; J. Brennan, Brisbane, Queensland. No. 54814: Ploughshare; J. McRae, Springburn. No. 55659: Fruit-grader; W. McBirney, Rarotonga.
 No. 55762: Milking-machine attachment; J. H. Mason, Feilding. No. 56760: Coultter-buckle; P. and D. Duncan, Ltd., Christchurch. No. 56830: Manure-distributor; F. T. F. Evans, Auckland. No. 57249: Fencing-post; H. L. Schaeffer, Eskdale. No. 57420: Sheep-shear flexible coupling; J. Davidson, Sydney, N.S.W. No. 55557: Butter-tray; L. Malaghan, Dunedin. No. 55825: Incubator; C. T. Price, Dunedin. No. 57466: Sheep-shears friction-drive; J. Davidson, Sydney, N.S.W. No. 57575: Manure-distributor marker attachment; F. T. F. Evans, Auckland. No. 57623: Tripod harrow; F. T. F. Evans, Auckland. No. 55433: Dressing flax; F. V. Raymond, Auckland. No. 55761: Milking-machine valve; J. H. Mason, Feilding. No. 57621: Harvesting-machine; W. Mitchell, East St. Kilda, Victoria. No. 55630: Scutching-machine; M. H. Wynyard, Onehunga. No. 56950: Ploughshare; W. Mackay, South Yarra, Victoria. No. 57767: Wool-pack; J. O. Viney, Melbourne. No. 57827: Destruction of pests; Hart and Co. Proprietary, Ltd., Melbourne.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office; or fees may be remitted by Post Office order or postal note.

FARM MACHINERY IN NEW ZEALAND.

THE particulars tabulated below are compiled by the Census and Statistics Office. It will be noticed that electric motors and agricultural tractors have both almost doubled in 1926 as compared with 1925. In 1921 the number of electric motors returned was only 456.

	1925.	1926.		1925.	1926.
<i>Farm Engines.</i>			<i>Farm Machinery and Implements.</i>		
Water-power—			Reapers-and-binders ..	15,881	15,574
Number of wheels or motors	846	967	Threshing-machines ..	477	361
Approximate horse-power* ..	3,325	3,614	Chaffcutters ..	2,993	2,865
Electric—			Wool-presses ..	8,601	8,641
Number of motors ..	3,451	6,356	Cream-separators ..	44,656	45,765
Nominal horse-power ..	7,235	12,631	Milking-plants—		
Steam—			Number of plants ..	15,561	16,391
Number of engines ..	622	473	Number of cows capable of	56,226	58,648
Nominal horse-power ..	2,975	2,221	being milked simultane-		
Internal combustion—			ously		
Number of engines ..	19,894	19,434	Total number of cows milked	705,033	729,772
Nominal horse-power ..	62,794	61,706	on 31st January		
Portable or traction—			Shearing-machines—		
Number of engines ..	854	832	Number of plants ..	5,728	5,949
Nominal horse-power ..	5,427	5,456	Number of stands ..	18,445	18,797
Agricultural tractors—					
Number of tractors ..	1,026	2,025			
Nominal horse-power ..	17,222	32,360			

* Being aggregate power of cases where specified.

FORTHCOMING AGRICULTURAL SHOWS.

Rotorua A. and P. Association: Rotorua, 23rd March.
 Methven A. and P. Association: Methven, 31st March.
 Temuka and Geraldine A. and P. Association: Geraldine, 31st March.
 Malvern A. and P. Association: Sheffield, 21st April.
 Flaxbourne A. and P. Association: Ward, 27th April.

The New Zealand Journal of Agriculture.

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WELLINGTON, 20th APRIL, 1927.

No. 4.

"PULPY KIDNEY" DISEASE OF LAMBS.

INVESTIGATION IN CENTRAL OTAGO, SEASON 1926.

D. A. GILL, M.R.C.V.S., D.V.S.M., Veterinary Laboratory, Wallaceville.

FOR many years, throughout New Zealand where the fat-lamb industry is carried on, sudden deaths have occurred among lambs at the age of about three to four weeks. Post-mortem examinations of the carcasses have shown a pulpy condition of the kidneys and an excessive quantity of fluid in the heart sac. The lambs which died and showed these lesions were always exceptionally forward for their age, and almost invariably single lambs. Gilruth first investigated the disease, and after much careful work concluded that the trouble was of dietetic origin. The views he formulated are still held to-day—namely, that the condition is the result of the lambs being "done" too well, and that losses may be checked by such means as exercise, reduced diet, and blood-letting, these methods having proved highly effective in many instances.

In Central Otago the mortality among fat lambs of the age stated has increased very considerably within the past four or five years. In considering the general circumstances in which this has occurred, two outstanding facts must be borne in mind—(1) Within the last ten years, and more especially in the last five years, there has been a gradual increase in the use of Romneys—a breed which thrives and fattens exceedingly well in that district; (2) rabbits, which were present in vast numbers a few years ago, are now comparatively scarce, so that, generally speaking, the carrying-capacity of the land has been much increased, whereas in many cases the stock actually carried has not been increased proportionately.

In view of the heavier losses occurring there, the sheep-farmers of Central Otago approached the Department of Agriculture with a request that special investigation into the matter be carried out in their district, and since it was realized that much was still unknown regarding the actual bodily changes culminating in death, and as there was the possibility that more detailed inquiry into the matter might bring to light further points regarding prevention, the request was readily granted.

General Scheme of the Investigation.

After careful consideration the following plans were decided upon :—

Four suitable farms were to be selected—two on which losses from the disease in question habitually occurred, and two on which this was not the case. Analyses were to be made of the soil and pasture of these farms, and of milk-samples from ewes with twins and ewes with single lambs. Milk for analysis was also to be obtained from ewes whose lambs had died of the disease, if this were possible, and additional soil, pasture, and milk samples as the circumstances suggested. (This part of the plan was carried out as arranged, and the analyses made by the Department's Chemist and his staff, together with Mr. Aston's remarks regarding the results and on the subject generally, are presented in an accompanying article.)

Post-mortem examinations were to be made as thoroughly as possible, and materials to be collected for bacteriological and pathological examination. Further, all circumstances connected with the occurrence of the disease were to be carefully noted.

Since the state of the kidney is the most pronounced lesion found, it was considered necessary to take samples of blood at intervals from selected ewes and lambs on the four farms, so as to discover by biochemical methods if there existed any damming back of waste products in the blood as a result of inadequate functioning on the part of the kidneys.

It was felt, moreover, that while there could be no doubt that the disease was responsible for considerable losses, there were probably other causes for some of the deaths, and that possibly this accounted for the seeming failure in some cases of the preventive measures advocated.

The investigation was commenced in Maniototo County, with headquarters at Ranfurly, on the 14th October, 1926, at which date few losses had occurred, though elsewhere—Oamaru, for example—where the season is a little earlier, there had already been a heavy mortality.

Seasonal Occurrence of the Disease.

In Maniototo during the investigation the period when losses were greatest was from about the 20th October to the 8th November. Deaths occurred for some days prior to this period and gradually increased, then fell off rapidly in the early days of November. It has been the experience of all who were questioned that the same sort of thing happens annually, the losses always occurring about this time—a little earlier or later according as the season is a forward or backward one. In *rare* cases deaths occur in older lambs—-from four to five months—and at other times of the year. A case of this sort has occurred recently, the post-mortem findings being typical of the disease in question.

Type of Lamb affected.

Sex : Personal observation, and reports from farmers who were good enough to keep notes of such things, show that, taken over large numbers, the sexes are about equally liable prior to marking, whereas among lambs dying after marking ewes are in the majority.

Breed : Romneys, Corriedales, and crosses of these two breeds seem to be most liable in the district under consideration, but this is probably

not significant, since the great majority of sheep in the district can be grouped under these headings. The following experience of a Kye-burn farmer, though it was possibly a coincidence, seems sufficiently striking to be worth relating: To a mob of 140 old ewes he put Romney, Corriedale, and Shropshire Down rams, and 114 lambs were born, of which half were sired by the Shropshires. The lambs all appeared to thrive equally well, but, while 12 per cent. of the Romney and Corriedale progeny were affected and died, none of the Shropshire crosses suffered at all. There are some grounds for thinking this to be other than a mere coincidence, and the point will be inquired into further.

Age: As already stated, there are rare cases where older lambs are affected, but in the vast majority of cases the lambs which die are from two and a half to four weeks old—that is, in about the fourth week of life.

Twin lambs: While these are not entirely immune, the deaths among twins are negligible in number compared with those among singles.

Condition: One of the most striking facts about this disease is that the lambs dying of it are invariably in extremely forward condition. It occasionally happens that lambs die of the disease on pasture which appears to be rather poor than otherwise, but here, as in all other cases, the size, weight, and fatness of the carcase were quite remarkable for a lamb of that age.

Nature of Pastures where Deaths occur.

The following two subsections (ending on page 222) are an abstract of a report by Mr. E. Bruce Levy, the Department's Agrostologist, dealing with the pastures of the district under investigation from two points of view—(1) food production, and (2) the possible presence of a poisonous weed or weeds which might cause the losses.

FOOD-PRODUCTION.

The pastures on which the greatest mortality occurred consist of the following grasses and clovers: Perennial rye-grass, white clover, suckling-clover, and *Poa pratensis*, and small quantities of cocksfoot, crested dogstail, English trefoil, and red clover. The following are botanical analyses of certain of these pastures—

Analysis No	1.	2	3	4	5	6
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Bare ground ..	1	10	11	41	45	11
Perennial rye-grass ..	51	52	55	78	50	60
White clover ..	30	12	7	10	1	15
Suckling-clover ..	..	25	11	..	22	13
<i>Poa pratensis</i> ..	8	1	18	..	..	..
Crested dogstail ..	6	1	..	..	..	..
Goose-grass ..	..	4	..	7	10	3
Hair-grass ..	..	1½	1	1½	5	..
English trefoil ..	..	1½	..	..	..	..
Cocksfoot ..	..	..	..	..	..	..
Red clover ..	..	..	..	..	..	3
Yorkshire fog ..	..	..	..	..	..	2
Weeds (catsear, &c.) ..	5	2	5	3½	12	4

On examining these analyses it is readily seen that rye-grass, white clover, and suckling-clover form the bulk of the food the ewe is getting, and this irrespective of the fact that in many paddocks virtually half the area is bare ground.

On pastures that were poorer in composition than those tabulated the mortality was not so high. Bulk of food such as is provided by lucerne, young luscious grass, or young pasture with a good proportion of red clover in it seems also to reduce mortality. The following are analyses of paddocks where virtually no losses occurred:—

Analysis No.	7.	8.	9.
	Per Cent.	Per Cent.	Per Cent.
Bare ground	16	35	11
Perennial rye-grass	1	44	12
White clover	9	29	16
Suckling-clover.. .. .	22	..	..
Poa pratensis	1	..	..
Goose-grass	22	..	25
Hair-grass	23	..	39
Chewings fescue	3	..	..
Red clover .. .. .	..	27	..
Weeds	19	..	8

A number of other old pastures where no deaths were occurring were carefully examined, and in the majority of these the absence of springing rye-grass and clover was quite marked.

In Maniototo the old pasture rye-grass is short and nutty, and is probably the most highly concentrated rye-grass to be found anywhere in New Zealand. A significant fact is that in some parts of Taranaki where sheep pastures have been top-dressed to improve their feeding-value the mortality among fat lambs has notably increased. A mixture of white clover and rye-grass is excellent for milk-production by ewes, and its good qualities are enhanced in Maniototo by the large amount of available phosphate in the soil (larger than elsewhere in New Zealand) and by the low rainfall, which results in a short, nutty growth. This latter fact is of much importance. A luscious, watery growth has not the same food value, bulk for bulk, and, moreover, has a tendency to scour the animal and thus reduce the milk-yield. On the whole, conditions in Maniototo at this time of the year (late spring) are ideal for the production by the ewes of large quantities of milk, which their lambs never seem to tire of taking. Young lucerne, for example, which is a highly concentrated food as far as its dry matter is concerned, contains much water, so that *bulk for bulk* it is not as good a milk-producing food as the rye-grass and white-clover mixture. It has, in addition, a tendency to scour the ewe owing to the amount of protein present in it. Red clover, similarly, is a bulky food, and its presence to the extent of 27 per cent. in the foregoing analysis No. 8 probably accounts for the absence of deaths in that excellent pasture. Again, as grasses mature and approach the seeding stage their value for milk-production declines; the same applies to spelled and rough pastures.

Systematic work on the relative food values, mineral content, &c., of the common grasses and clovers from different soil types, and at

all stages of growth, would greatly facilitate an investigation of this kind.

The farmer who suffers these losses should do his utmost to regulate the quantity and quality of food the ewe is getting as the lamb approaches the danger line—that is, during its third or fourth week. The following practices suggest themselves:—

(1) Where all the paddocks are in good, old rye-grass and white clover, concentrate the ewes and lambs on a smaller area. Although many paddocks show a large proportion of bare ground, it must be remembered that if the pasture there is of the type indicated, and the place be lightly stocked, the ewes can still get ample of this highly concentrated food to produce excessive quantities of milk. Overstocking during the danger period is the only way to overcome this.

(2) Grow more young pasture and bulky foods such as lucerne and red clover. The inclusion of red as well as white clover with all pasture sowing would help in rendering the young pastures more bulky, and in addition to its other uses the growing of more lucerne would provide more winter hay, so that more ewes could be carried.

(3) Shift and drive the ewes and lambs daily before and during the danger period.

The elimination of rabbits is having a bigger influence on the vegetation of the district than most farmers realize. The young spring growth that usually was eaten or spoilt by rabbits is now available for sheep, and an increased milk-flow from the ewes follows as a natural course.

THE POISONOUS-WEED THEORY.

Regarding the possibility of some poisonous plant being responsible for the disease, the common weeds of the Maniototo country are the following: Catsear (*Hypochoeris radicata*), dandelion (*Taraxacum officinale*), sorrel (*Rumex acetosella*), storksbill (*Erodium cicutarium*), willow herbs (*Epilobium* spp.), cudweed (*Guaphalium collinum*), Californian thistle (*Cnicus arvensis*), Scotch thistle (*Carduus lanceolatus*), speedwell (*Veronica Luxbaumi*), slender chickweed (*Cerastium triviale*), short-stalked cranesbill (*Geranium sessileflorum*), and mouse-eared chickweed (*Cerastium vulgatum*). To these may be added certain inferior weed grasses as follows: Goose-grass (*Bromus hordeaceus*), hair-grass (*Festuca bromoides*), English hair-grass (*Aira caryophyllea*), and desert poa (*Poa Maniototo*).

Throughout the tussock country there is also a great assortment of weeds and small indigenous herbs, comprising the following species: Yellow oxalis (*Oxalis corniculatus*), silky cotula (*Cotula perpusilla*), pipiriri (*Acaena* spp.), colobanth (*Colobanthus brevisepalus*), scabweeds (*Raoulia* spp.), New Zealand field daisy (*Lagenophora pumila*), New Zealand violet (*Viola Cunninghamii*), forget-me-not (*Myosotis pygmaea*), Buttercup (*Ranunculus lappaceus*), New Zealand broom (*Carmichaelia Petriei*), patotara (*Leucopogon Fraseri*), swamp lily (*Chrysobactron Hookeri*), wild irishman (*Discaria toumatou*), porcupine scrub (*Hymananthera dentata*), cushion pimelea (*Pimelea sericeo-villosa*).

The only one of this list which might be suspected is the cushion pimelea, since in Taranaki and Wairarapa an allied species—Strathmore weed—has been known to cause deaths among horses. However,

in Maniototo the cushion pimelea is commonest on the harder, poorer country, where the lamb mortality is light or absent, and on the higher country up to 2,000 ft. where this disease does not occur. On many of the farms where the mortality is highest this plant is entirely absent.

It can be definitely stated that no other of the foregoing weeds is poisonous, and the weed-poison theory for the trouble may be ruled out. [End of abstract of Mr. Levy's report.]

Symptoms and Post-mortem Lesions.

In the vast majority of cases of the disease no symptoms are seen, lambs apparently in excellent health being found dead a few hours later. Generally they are found dead in the morning, and the bodies are usually near the nightly camping-ground. Through the kindness of several of the farmers sick lambs were brought to headquarters, and a few were seen on the farms. In only six instances, however, was it confidently felt that they were suffering from the disease in question. The symptoms in these instances were as follows: The lamb lay stretched on its side, the expression was drawn and suggested considerable pain, head stretched out, breathing rapid and jerky, pulse small and ranging from about 90 to 100, heart-sounds dull, and membranes of the mouth and eye showing a blue tinge. At short intervals there was given a choking bleat, suggestive of extreme pain, the whole body quivered for a while, and then became quiet until the next spasm occurred. These lambs were all killed while in this condition in order to obtain perfectly fresh specimens and to observe the state of the organs in such circumstances.

Before dealing with the condition found in these six cases it will be as well to describe what is seen at the more usual post-mortem— one held upon a lamb found dead. In these the abnormalities found were as follows (nearly one hundred cases showing these lesions having been examined): Kidneys: The outer portion of kidney substance (cortex) is reduced to a red, jelly-like pulp, the central part being less affected and sometimes quite firm. Both kidneys are affected in all cases. Sometimes a red, mottled appearance is seen before the kidney capsule is cut. This is due to hæmorrhage in the substance of the organ, and is not, as farmers often imagine, an indication that only parts of the kidney are affected. Liver: This is intensely congested with blood, so that on cutting into it this fluid oozes out in large quantities. Heart: The sac in which the heart lies (pericardium) is distended to a variable degree with straw-coloured fluid, in which, if the lamb has been dead some time, one finds yellow clots of fibrin. On cutting into the heart one finds in the lower cavities (ventricles) slight hæmorrhages under the lining membrane. Apart from these, there are no other noteworthy lesions found in the carcase.

In the case of a lamb killed while suffering from the disease the same lesions are found, except that the kidneys, although enormously congested with blood, are still quite firm. The pulpy condition develops very quickly after death, and results from the enormous quantities of blood imprisoned in the kidney vessels pressing on and distending the tissue, and subsequently clotting and shrinking there.

Deaths of Lambs from other Causes.

As stated in the introduction, it was thought highly probable that many deaths occurred which by the farmers were attributed to this disease while in reality they were due to other causes. This proved to be the case, and the following brief notes may be of value to farmers in enabling them to assess the true position more accurately in future:—

MARKING.

Odd cases of blood-poisoning occur, but are usually recognized as such by the farmer.

Hæmorrhage following the marking of ram lambs is probably a much commoner source of loss than is realized. Several farmers stated that they had observed this condition, and the following instance shows its importance: A report was received that several lambs were dead in a mob which had been marked the previous day, and a visit was made forthwith. Eleven dead lambs were found, and of these seven were males, which had quite obviously died as a result of hæmorrhage, the whole available space in the abdominal cavity being filled with clotted blood. One of the remaining four was obviously mismothered, and the other three—ewe lambs—were dead of causes other than so-called “pulpy kidney.”

BLOATING.

Bloating is a danger which should be duly considered by the farmer where luscious feed, such as lucerne and even young grass or oats, is used for depasturing ewes and lambs. The danger is not great when the stock are on these feeds constantly; for example, ewes can be lambed on lucerne and kept there without much risk. The danger lies in giving stock a brief spell on such feeds. The food is attractive and appetizing, and, being unaccustomed to it, the lambs are very liable to eat it too greedily. The following instance of this shows the danger well: A farmer who had about five hundred lambs this past season drove them daily some distance along a road to a lucerne paddock, where they grazed for an hour or so and were then driven back to their paddocks. Out of thirty-six fat lambs which died, thirty of the deaths resulted from bloating.

WANDERING AND BLIND LAMBS.

Although in the aggregate a large number of lambs are affected in this way, the loss to the individual farmer is not great, the largest loss encountered from this cause being 1 per cent. The condition is a peculiar one and easily recognized. The affected lambs wander dully round, with the head held low, and in nearly all cases in a one-way circle, either always to the left or always to the right. The circle may be large, or so small that the lamb turns round and round on its own axis. Some of them wander aimlessly in any direction. In either case, when their wandering brings them to any solid obstacle, such as a bush or fence, they bore into it with their heads and lean forward on it. Examination shows them to be blind in one or both eyes, though the eyes appear quite normal. If the lamb is blind in the right eye it wanders in a circle to the left, and *vice versa*. Several post-mortem examinations were held on lambs so affected, and in all



FIG. 1 BLIND LAMB TURNING IN A CIRCLE

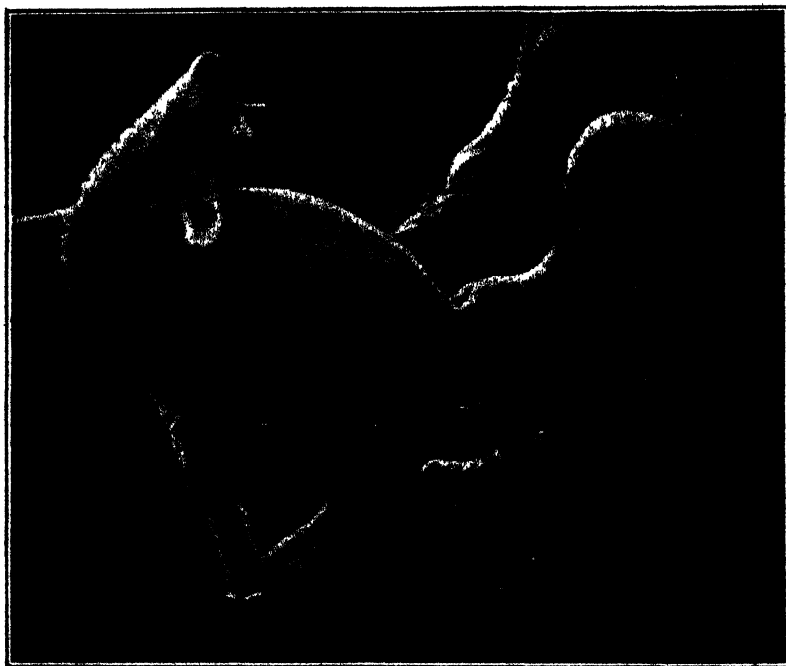


FIG. 2 LAMB WITH TETANIC SYMPTOMS

cases there was marked fatty degeneration of the liver, the tissue being very noticeably yellow in colour ; there was much bile-stained mucus in the duodenum (intestine leading out of the fourth stomach), and in some cases there seemed to be an excessive amount of fluid in the cranial cavity. Probably this latter exists in all cases, but it is exceedingly difficult to estimate at a post-mortem conducted in the field.

Some lambs so affected recover automatically, though they rarely thrive afterwards. One ewe was seen which, as a lamb, had wandered in a circle. She was well grown and a good mother, but was very excitable and would not go with the rest of the flock. Examination showed her to be blind in the left eye still, though she no longer wandered in a circle. If it is considered desirable to attempt treatment in such cases, the best results are obtained by withholding all food for a few days, keeping the lamb in a dark, quiet place, and giving a daily dose of $\frac{1}{2}$ oz. to 1 oz. of Epsom salts. When improvement commences a little milk can be given. Fig. 1 shows a typical case of this trouble.

TETANY.

Apart from occasional cases of lockjaw, resulting from infection at marking-time, there is a fairly common condition which closely resembles this disease in the symptoms shown. One good reason for mentioning it is the opinion expressed by several farmers that it might be due to strychnine poisoning. While its actual cause is not definitely known, it does not appear to be either lockjaw or strychnine poisoning. It was possible to entirely rule out the latter possibility in numerous cases where careful inquiry was made. The possibility of its being due to what is known as alkalosis, which is typically manifested by tetany, was duly considered and disproved. Post-mortem examination revealed that there was very intense constipation in all such cases, and this, together with the fact that manipulation of the abdomen in the lamb before death caused intense pain, suggests this as the cause of the condition. Marked and unmarked lambs are equally liable. Fig. 2 shows a typical case.

Preventive Measures advocated.

EFFECT OF MARKING.

Reference to the following table will make it easy to understand why many farmers in the district have no faith in marking as a preventive measure.

Farm.				Total Number of Fat Lambs lost.	Before Marking.	After Marking.
1	..	..	..	70	43	37
2	..	..	..	24	10	14
3	(one paddock only)			9	4	5
4	..	..	..	30	10	20
5	..	..	..	60	30	30

Closer consideration, however, shows that these figures are not a true indication of the efficacy or otherwise of this method.

No. 1 Farm, as is usual in the Maniototo district, had only one marking. Many of the lambs were very young at the time, and such check as they received was quite overcome by the time they reached the danger age. Lambs were dying rapidly before marking; several died just before or immediately after the operation. Then there was a lull of several days till the younger lambs overcame the check and reached the danger age. The same remarks apply in general to Farms 4 and 5.

No. 2 Farm: Of the fourteen lambs which died after marking, the death of at least eleven was from other causes, these being the eleven previously referred to in connection with hæmorrhage after marking.

No. 3 Farm: Four of the deaths after marking occurred on the second day. No post-mortems were made, but the fact that nearly half the total death-rate in that paddock occurred on the second day after marking, and that three of the four lambs which died that day were males, is strongly suggestive of some cause associated with the operation.

The fact that, whereas the sexes are equally affected prior to marking, more of the ewe lambs die afterwards is undoubtedly significant, since the ewe lambs get a much slighter check. In general only one marking is held, and as the ewes are not drafted into mobs as they lamb it is impossible to draw any conclusions regarding the matter which will stand close criticism. Only one man was met with who drafted his ewes and marked systematically, keeping records of his losses. Fourteen lambs died before marking, and sixteen afterwards; but on his own statement he did not open many of the carcases, and of those he did examine only a few showed "pulpy kidney."

The co-operation of some of the farmers will be sought next season to test the method carefully under properly controlled conditions to avoid erroneous conclusions.

EXERCISE.

Many farmers stated that they had tried exercise and found it useless, but on closer inquiry it turned out that they had only commenced moving the lambs about when several had died, and the average age was three to four weeks. As with marking at a given age, so with moving the stock, the fact that the ewes are not drafted as they lamb makes it impracticable to exercise properly. Speaking generally, the bulk of the lambing extends over about three or four weeks, and consequently in a given paddock there are lambs three weeks of age, which may be found dead almost any hour, mixed up with newly dropped lambs and ewes still pregnant. Obviously it is impossible to exercise such a mixture of stock adequately.

The following instances go to show how easy it is for a suggested preventive measure to get into disrepute:—

"A," who had numerous losses from "pulpy kidney" in 1924, tried exercise in 1925, and apparently derived much benefit from it. This season he exercised again, depasturing daily on to lucerne, after driving some way along the road. (This case is referred to in connection with bloating.) He lost twenty lambs in a comparatively short time, and was attributing his loss to the disease under investigation, till a visit to his farm and a demonstration on a freshly dead lamb showed him conclusively that bloating was the trouble. Up to my departure from the district he had lost thirty-six fat lambs in all—thirty by his own account from bloating, five from the wandering sickness already referred to, and one from pleurisy, but none from "pulpy kidney."

"B" had suffered heavily, and in 1925 made a thorough effort to prevent the disease. In addition to marking, he docked four

times at fortnightly intervals, and provided exercise by driving in batches from the paddocks to a field of green oats for an hour or two daily. His losses were heavier than in the previous year, when no precautions were taken. As far as is known, none of these lambs was opened; but in the light of "A's" experience this year it is more than probable that here again the deaths were due to bloating.

An objection often raised by farmers when urged to exercise their lambs is that it will give them such a check that they will not be in the first grade when drafted to the freezing-works in the autumn. Having this in view, it is intended to carry out experiments in exercising lambs, and to ear-tag the experimental animals so that they can be watched at the grading-scales when killed. •

OVERSTOCKING OR PLACING ON BARER PADDOCKS, ETC.

The desirability of these courses, before and during the danger period, has already been stressed in the abstract of Mr. Levy's report. It will suffice to give a few instances where these methods were tried.

(1) A mob of 250 ewes with 280 lambs were running on a good, old, white-clover and rye-grass pasture. Fifteen lambs died there. The mob was then crammed on a 50-acre paddock of young rye-grass and left there. Three lambs died next day (no post-mortem made—deaths possibly due to bloating), one died the following day, and two more a week later, after which all trouble ceased.

(2) On the same farm 113 ewes in not very good condition were placed on 60 acres of grass at lambing and left there. No deaths occurred at all.

(3) In this case there were 202 ewes with lambs. Four lambs died up to 23rd October, on which day they were marked. On the 24th three lambs died (one from blood-poisoning), and the mob was moved to a bare paddock. No deaths occurred after the move. Returned to good pasture on 7th November, and still no deaths occurred.

(4) This was another mob on the same farm as (3)—208 ewes with lambs. Four deaths occurred up to 27th October. Marked on that day and placed on good pasture. Deaths continued up to 7th November, when they replaced the previous mob on the bare paddock. Deaths ceased from that day.

(5) An interesting experiment was carried out by a Gimmerburn farmer. Out of a mob of 290 lambs twelve died, presumably from "pulpy kidney." He then took the ewes and lambs off the paddock and yarded them. The older ewes were kept in the yards for fourteen hours, and again for a similar period four days later. The younger ewes were given one spell of twenty-four hours in the yard. With the exception of one lamb which died while yarded up, the losses stopped in this mob from the time the experiment began.

EWES' CONDITION AT LAMBING.

So many factors come in to fog the field of inquiry in this connection that nothing in the way of definite evidence could be obtained either one way or the other. As will appear later, the amount of milk yielded by the ewe is of great importance, and it is well known, both with cows and sheep, that a beast that is "done" well during the winter will

milk better than she would have otherwise. When the dam is in good order at parturition she tends to give abundant milk for a considerable period, even when the diet she gets at that time is not of first quality, because during the dry period reserves of materials have accumulated in the body from which she can draw supplies for milk-production. This may be the explanation of the occasional deaths from the disease among lambs on poor pasture. In any case, that the ewes in these instances are somehow finding the wherewithal to feed their lambs extraordinarily well is shown by the bodily condition of those which die. Another fact having a bearing on this side of the question is that losses are very noticeably slighter among the progeny of two-tooths than among that of maturer ewes.

Laboratory Examination of Specimens.

It would serve no useful purpose in an article of this nature to go into technical details concerning individual specimens examined at Wallaceville. Such bacteriological work as was done yielded no evidence whatever of an infecting germ being causative of the disease. Examination of portions of affected kidney afforded no evidence that the condition found in them was the result of an attempt to eliminate any poisonous material. As already stated, the pulpiness is the result of extreme engorgement with blood prior to death. Examination of the liver showed intense congestion with blood, and the liver-cells appeared to be loaded to a somewhat unusual extent with a substance, probably glycogen—the form in which the body stores up its carbohydrates (starches and sugars)—and in addition showed a varying degree of fatty infiltration. It seems very possible that these points in connection with the liver-cells have a profound bearing on the subject.

Thanks to the co-operation of four of the local sheepfarmers we were able to secure some hundreds of samples of blood from ewes and lambs. The object of this was to discover by periodical analysis of blood from individual ewes and lambs whether there was any noteworthy change as the lamb approached and passed the danger age. As already stated, the kidney lesion is the most obvious one in this disease, and it was thought that possibly the kidneys were not functioning properly for some time before death; that consequently waste products were accumulating in the blood; and that when these products reached a certain limit acute illness and more or less sudden death resulted. However, these samples and certain others procured from lambs suffering from the disease have served the very useful purpose of disproving that idea. There is no accumulation of nitrogenous waste products, nor of chlorides, in the blood of affected lambs; consequently it must be readily understood that there is no impairment of the kidneys' excretory function prior to the sudden onset of the illness.

In view of an opinion expressed publicly in Southland last December it appears desirable to lay still further stress on the following point: There are good grounds for thinking that prior to the onset of acute symptoms the kidneys are normal and function normally. Before death the kidney is enormously congested, and in specimens obtained at that time the kidney-cells, including the lining cells of the tubules, are still normal, apart from a trifling degree of cloudy

swelling which is readily accounted for by the pressure exerted on them through the distension resulting from such extreme congestion. This is in direct contradiction of the statement in question that "the kidney-tubes are destroyed." When the kidney becomes pulpy after death the tubes may with some truth be described as "destroyed," but this is a post-mortem change. It is hoped that the present statement, together with the results of Mr. Levy's exhaustive botanical survey of the affected area in Maniototo, will prevent further eruptions of the "poisonous-weed theory."

Tentative Conclusions from the Season's Work.

The outstanding facts upon which theories can be based are as follows: (1) The disease occurs with extraordinary regularity at a definite period lasting approximately three weeks; (2) affected lambs (typically affected with the disease as judged by kidney, liver, and heart lesions) are approximately three weeks of age, are in exceptionally forward condition, and are taking grass as well as milk; (3) although deaths occasionally occur on poor country, the type of lamb to die is always as just stated.

The type of lamb to die is quite definite, so that its primeness must be either the cause or the predisposing factor in the condition. Regarding the age of the lambs, and the season when the deaths occur, it is about that age that the lamb has started grazing, and at that season the greater part of the herbage is in the leafy stage prior to the shooting of the flowering head—that is, at the most potent stage for promoting milk-production; moreover, its nitrogenous components are undergoing rapid changes from the non-protein to the protein form. (In passing it is worth noting that there appears to be nothing definitely wrong with the ewe's milk except its great quantity; motherless lambs are frequently twinned on to ewes whose lambs have died of "pulpy kidney," and do quite well.)

These points, taken in conjunction with all that has gone before, suggest the following: A quickly developing type of lamb is supplied with abundance of milk from birth; it reaches in an overfat condition the age when grazing commences; it is plethoric and lazy, and its digestive organs are consequently lacking in tone and sluggish in their action. At this stage the nature of the pasture increases the milk-yield of the ewe, thus throwing extra strain upon the lamb's alimentary tract, and, through this, on its system generally. The lamb now starts picking about for itself, and in the course of a day not only ingests a large quantity of milk, but also a varying amount of highly nutritious herbage. It seems feasible to think that the atonic digestive organs, already fully occupied in dealing with a copious milk diet, may not be able to deal effectively with the various protein breakdown products derived from its own tissues (muscles, &c.) and from the intestine. Sundry poisonous products of this nature are normally formed in the body, and in a state of health are dealt with by the liver in such a way as to render them non-toxic. (As already mentioned, there is a strong suspicion that the liver-cells are overloaded with glycogen and fat in cases of this disease.) Some such products do have a profound effect upon the blood-circulation, and, as it has been endeavoured to show,

the lesions found in "pulpy kidney" disease are due to circulatory disturbances.

It must be clearly understood that the preceding paragraph is not intended as a statement of fact. It appears, however, to be the theory which best fits the case, and it is felt that herein lies the most hopeful working hypothesis for future technical investigation. Additional bacteriological and other work will also be undertaken.

The occasional cases of this disease occurring in older lambs later in the season are highly interesting. The recent instance referred to affected fifteen stud lambs in high condition that had been rounded up for dipping. The remainder of the lambs were promptly weaned and no further losses occurred. Such instances rather support than detract from the probability of the theory outlined.

Suggested Experiments in Prevention for Next Season.

Whereas investigation on the foregoing lines is a matter of great scientific interest, actual practical results—in other words, a saving to the farmer's pocket—can be accomplished only by properly controlled experiments with the various preventive measures that are advocated. For these trials controls are essential, and preferably should embrace a fair half of the flock. Experimental mobs must be drafted into batches according to lambing-dates.

It is hoped that co-operation will be forthcoming to try the following: Daily exercise, commencing at ten days of age, docking at fourteen days and marking at, say, eighteen days of age, yarding ewes and lambs nightly, yarding ewes and lambs at other and various intervals; overcrowding without exercise or extra marking, combinations of overcrowding, exercise, and extra marking; use of various crops such as lucerne, young grass, &c, feeding ewes during pregnancy with the object of lowering the milk-yield.

The ewes must be duly selected so that they are fairly representative. Post-mortem examination must be made by a veterinarian on all lambs dying in experimental flocks, and for future identification at the works experimental animals must be given numbered ear-tags.

It will be appreciated that the work of arranging and supervising a programme of this sort will be very considerable, and it is hoped to make an early start.

In conclusion, I have to make due acknowledgment of the help received from Mr. David Weir, Stock Inspector at Ranfurly. His knowledge of the district and of the local farmers was most useful, and the large amount of additional work which was entailed upon him was always well and willingly done. Mr. P. McGregor, Government Veterinarian, was associated with me during part of the investigation, and his help was much appreciated. The authorities and staff of the Medical School, Dunedin, have my sincere thanks for the facilities afforded me, and particularly Miss S. Woods, M.Sc., who carried out the analyses of blood-samples, which lack of facilities at Ranfurly made it impossible to perform there. Professor Malcolm, of Otago University, took a very keen interest in the work, and his kindness in placing his knowledge of physiology at my disposal was greatly appreciated and very helpful.

MORTALITY AMONG LAMBS IN CENTRAL OTAGO.

CHEMICAL ANALYSES OF PASTURES, MILK, AND SOILS.

B. C. ASTON, F.N.Z.Inst., Chemist to the Department of Agriculture.

THE soils of Central Otago, which are derived from the mica-schist rocks, have so far upon chemical analysis yielded a high amount of "available" phosphoric acid soluble in a 1-per-cent. solution of citric acid, as in the Dyer method for determining available plant-food (see this *Journal*, Vol. 26, No. 6, p. 329). The fertility of the Otago Central soil is proverbial, and is probably due to the high amount of available phosphate present.

Mechanical analyses of soils upon which mortality among lambs occurred last spring compared with one on which there were no deaths from "pulpy kidney" show that there is no perceptible difference in the physical composition of the soils. Chemical analyses, however, show that the available and total phosphate in the soil of the property upon which no mortality occurred is much lower than in those analysed from farms upon which the losses were heavy. From this one may infer that, other factors being equal, the land where the lambs enjoyed immunity from this trouble would not grow such a rich pasture as that upon which the trouble was rife.

The results of the pasture analyses presented in Table 1 show that most of these samples are contaminated with sand or silt, but Nos. 794 and 795 have all the characters of pure samples. The column headed "Fusion of Silica and Sand" represents the fusion of the hydrochloric acid insoluble portion with carbonate of soda. From these ash-analyses one can say positively that the mineral foods given are present in good proportions, and there is no reason to suspect mineral deficiency.

The question arose whether the composition of the milk which the mother ewes gave—the milk being the largest portion of the diet of the lambs which died at the age of between four and five weeks—was in any way abnormal. The reply the writer gave to this was that, the ewes being healthy and on natural pasture, it was unlikely that there would be any change in the composition of the milk; that improved condition of diet or climatic environment would be reflected more in a change of volume of milk yielded than in change of composition. To test the matter fully, arrangements had to be made for the transport of the milk some hundreds of miles to the Laboratory at Wellington. This was effected by the use of thermos flasks. The ewes' milk, being much thicker than cows' milk, did not churn in the flasks. The samples were placed in the flasks after thorough cooling, and arrived at the Laboratory in good condition for analysis, without the use of preservatives.

The results of the analyses of the ewes' milk are shown in Table 2. A much more extensive series of analyses is required before expressing any positive opinion, but the results go to show that there is no great abnormality, and that the constituent that changes at all is, as in cows'

Table 1 Chemical Analyses of Pasture

The results are expressed as percentages of the sample dried to constant weight in water oven. Analysis performed on the ash for minerals. The insoluble silica, sand, and silt was fused with carbonate of soda and the constituents determined.

Sample	Locality	Description	Total Nitrogen	Crude Ash	Silica, Sand and Insoluble Matter	Iron Fe	Phosphoric Acid P_2O_5	Lime CaO	Magnesia MgO	Manganese Oxide, Mn_2O_3	Sulphuric Anhydride SO_3	Fusion of Silica and Sand		
												Alumina, Al_2O_3	Lime, CaO	Iron, Fe
W/728	Kyeburn	Pasture	$\left\{ \begin{smallmatrix} 2.71 \\ 2.77 \\ 2.74 \end{smallmatrix} \right\}$	13.45	5.46	5.02	0.056	1.198	0.55	0.015	0.806	0.22	0.084	0.010
729	Eweburn	Pasture	$\left\{ \begin{smallmatrix} 2.77 \\ 2.74 \\ 2.74 \end{smallmatrix} \right\}$	12.80	5.94	5.43	0.050	0.955	0.51	0.026	0.490	0.24	0.080	0.009
730	Gimmerburn	Lucerne	5.38	12.70	3.75		0.019	1.346	0.67	0.007	0.740			
758	Ranfurly	Pasture chiefly clover	3.90	11.40	1.16	1.88	0.055	1.016	0.63	0.011	0.380	0.16	0.075	0.006
759	Gimmerburn	Pasture	2.14	11.71	5.12	4.76	0.039	0.981	0.47	0.013	0.880	0.06	0.069	0.005
762	Kokonga	Mixed pasture	$\left\{ \begin{smallmatrix} 2.95 \\ 2.96 \end{smallmatrix} \right\}$	11.01	1.89	3.52	0.068	0.821	0.51	0.027	0.520	0.16	0.087	0.006
791	Kyeburn	Pasture	4.2	11.79	6.42	5.77	0.077	0.705	0.71	0.025	0.540	0.26	0.140	0.010
794	Wetderburn	Pasture	3.05	10.01	2.55	2.41	0.014	0.728	1.32	0.63	0.520	0.03	0.030	0.001
795	Wetderburn	Pasture	3.48	10.28	2.42	2.28	0.022	0.920	1.36	0.57	0.730	0.07	0.040	0.002
812	Wetderburn	Pasture	1.64	8.98	8.24	3.93	0.041	0.686	0.73	0.029	0.610	0.11	0.110	0.003
813	Wetderburn	Young rye grass	1.65	9.43	3.31	3.19	0.016	0.771	0.64	0.016	0.608	0.13	0.080	0.001
814	Wetderburn	Fenced pasture area	3.12	11.80	3.20	2.06	0.034	0.971	1.00	0.62	0.700	0.11	0.070	0.006
822	Ranfurly	Pasture	2.31	9.71	4.18	3.85	0.024	0.747	0.80	0.43	0.710	0.13	0.080	0.002

NOTE: Figures in brackets are duplicate determinations.

[Analyses by B. C. Atton and I. Cunningham]

milk, the fat. That the flow or yield of milk is exceptionally high there is some evidence, but further experiments are necessary to give accurate figures.

Table 2.—Analyses of Ewes' Milk

Sample.	Locality.	Fat.	Proteins. (N × 6.39.)	Total Solids.	Ash.	Remarks.
W/756	Kyeburn, No. 44 ..	2.5	4.6	13.9	0.98	Twin lambs.
757	Kyeburn, No. 39 ..	3.1	4.4	13.8	0.90	Single lamb.
760	Eweburn, No. 83 ..	4.9	4.4	15.2	0.98	Single lamb
761	Eweburn, No. 75 ..	2.3	4.5	12.8	0.99	Twin lambs
793	Kyeburn ..	4.3	4.4	14.6	0.96	Single lamb (died)
796	Gimmerburn ..	2.8	4.5	13.4	0.97	Twin lambs
797	Gimmerburn ..	3.6	4.4	13.9	0.93	Single lambs

[Analyses by F. T. Leighton.]

The fact that the mortality begins and ends so suddenly seems to be evidence of some seasonal change in the chemical composition of the pasture concomitant with early spring growth. Very early lambs do not fall victims, neither do late lambs, the period of maximum intensity of the mortality being from 20th October to 8th November. The fact that twin lambs do not suffer seems to be evidence that the milk is not poisonous but may be present in excessive amounts, and therefore more than the single lamb can assimilate without suffering in health. Either of these two hypotheses may be correct, or they may be operating jointly to produce the result.

The pasture samples were analysed for total nitrogen, with the results stated in the table. The result shows that nitrogen is not present in abnormally high amounts, except perhaps in one Wedderburn pasture (W/795). Godden (*Journal of Agricultural Science*, Vol. 16, p. 87, 1926) gives the analysis of a highly manured horse-paddock at Taplow as 3.562 per cent. nitrogen in dry matter, compared with average of cultivated pastures, 2.830 per cent.

There is the question whether the nitrogenous matter is present in the form most suited as food for the young lamb, and this is an aspect which will engage the attention of the Department's chemists during the coming spring. The few samples received were examined to determine if there was any radical difference between the chemical composition and the nitrogenous constituents of the Otago pastures with those of normal pastures elsewhere. The number of samples received is too small to warrant drawing any definite conclusions from the results, but the figures suggest lines for future work. The crude protein and true protein may be found to increase with the increase in mortality. There are wide variations in the figures for "amides" and for ratio protein/amides, which may be due to inadequate sampling. Results obtained from the Welsh Plant Breeding Station* showed great variations in composition in two consecutive years.

It appears desirable to continue the investigation, taking more adequate samples from a number of "healthy" and "unhealthy" farms over a period of years.

* Fagan and Jones: "The Nutritive Value of Grasses as shown by their Chemical Composition" (University College of Wales, Aberystwyth, Series H, No. 3, Seasons 1920-23).

Table 3.—Crude Protein, True Protein, and "Amides" in Pasture Samples from Central Otago, arranged in Approximate Order of Normality of Pasture—late October and early November, 1926.

Sample.	Crude Protein, per Cent. (N × 6.25.)	True Protein, per Cent.	Amides, per Cent.	Ratio: True Protein to Amides.	Remarks.
W/791 ..	15.12	12.31	2.81	4.4	Healthy pasture.
729 ..	17.19	12.25	4.94	2.5	Healthy pasture.
814 ..	19.50	13.63	5.87	2.3	Affected pasture.
759 ..	13.38	10.50	2.80	3.7	Affected pasture.
728 ..	17.38	12.50	4.88	2.8	Affected pasture.
762 ..	18.56	13.63	4.93	2.8	Affected pasture.
794 ..	19.26	14.56	4.70	2.3	Badly affected pasture.
822 ..	14.43	10.81	3.62	3.0	Badly affected pasture.
795 ..	21.81	14.75	7.06	2.1	Badly affected pasture.
Average ..	17.40	12.77	4.63	2.8	

[Analyses by L. D. Foster.

SUMMARY OF ANALYSIS OF PASTURE SAMPLES (TABLE 3) AND SOILS (TABLES 4 AND 5).

Pasture Samples.—(1) Compared with figures obtained from rye-grass grown and examined at the Welsh Plant Breeding Station, the Central Otago pastures—in which rye-grass is the dominant grass—are higher in true protein and also in the ratio of true proteins to amides.

(2) Compared with composite pasture samples grown and examined at Cambridge, England, the Central Otago pastures are low in protein, but considerably higher in the ratio of true protein to amides.

(3) The healthier pastures in Central Otago have possibly a lower true protein/amide ratio than those where mortality occurs.

Soils.—(1) The mechanical analyses show no differentiation.

(2) The chemical analyses show these soils to be high in total lime and total potash. They are also high in available potash and available phosphoric acid. The soil taken from healthy land, however, contained about half the amount of available and also total phosphoric acid that was present in soils from affected farms. Otherwise the three soils were similar.

GENERAL REMARKS.

It is questionable to what extent a rich proteid diet would affect lambs or other ruminants, but physiologists have observed that an excess of protein in the diet of mother rats causes mortality in the young during the lactation period. There is, further, the possibility that at a certain early stage in the growth of the pasture in the rich Central Otago soils there may be an abnormally high percentage of non-proteid nitrogenous constituents, such as amides and amido-acid compounds, which would exert a further strain on the already over-taxed digestive organs of young lambs overfed with excessive milk diet. A familiar example of the effects of such bodies is that of asparagus, which contains asparagine in quantity. Asparagus is eaten by man when the plant is in an exceedingly young stage, and when it contains

Table 4.—*Chemical Analyses of Soils.*
Results, except *, are percentages on soil dried at 100° C.

Sample.	Locality.	Volatile Matter.			Total Nitrogen.	1 per Cent. Citric-acid Extract. Dyer's Method, Hall's Modification. (" Available Plant-food.")				Hydrochloric-acid Extract. (" Total Plant-food.")				Remarks.
		*On Air-drying.	* At 100° C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K ₂ O.	Phosphoric Acid, P ₂ O ₅ .	Lime, CaO.	Magnesia, MgO.	Potash, K ₂ O.	Phosphoric Acid, P ₂ O ₅ .	
W/731	Kyeburn ..	..	1.30	5.13	0.158	0.195	0.040	0.023	0.035	1.18	0.55	0.74	0.10	Mortality.
732	Gimmerburn ..	..	0.74	3.63	0.113	0.187	0.046	0.021	0.042	1.32	0.50	0.68	0.09	Mortality.
733	Eweburn ..	..	1.20	5.57	0.193	0.175	0.034	0.026	0.022	1.45	0.47	0.76	0.05	No mortality.

Table 5.—*Mechanical Analyses of Soils.*

Results are percentages on air-dried soil.									
Sample.	Description of Soil. (Classification of U.S. Dept. of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.							Remarks.
		Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture and Loss on Ignition.	
W/731	Between silt and fine sandy loam	1.4	10.3	37.3	22.1	19.4	5.7	{ 1.3 5.1 0.7 3.6 }	Kyeburn. Mortality.
732	Between silt and fine sandy loam	1.3	10.8	43.4	21.8	14.7	5.7	{ 0.7 3.6 1.2 5.5 }	Gimmerburn: Mortality, poor pasture.
733	Between silt and fine sandy loam	1.7	11.0	31.4	26.1	19.3	6.2	{ 1.2 5.5 }	Eweburn. No mortality.

its nitrogen largely in the form of asparagine, a crystalline body which becomes changed in the more mature plant into insoluble protein. Such compounds as asparagine are usually abundant in the young growth of spring, especially in leguminosæ, whether those growths spring from rootstock or from seed. In the case of the Central Otago spring pastures, an abundant element coming from seed is the suckling-clover (*Trifolium dubium* (*T. minus*)), as it is an annual. It is quite possible that the grazing animal would obtain a sample of food differing from that picked by hand by the most careful sampler, and that hence samples sent to the analyst may not reveal the true richness of the sheep's diet in nitrogen.

The evidence seems to indicate that in years past the rabbits which overran the country mitigated the mortality by grazing off the very youngest and tenderest growth, but that now the rabbits are kept severely in check this growth is consumed by the sheep or lambs.

The whole question is a most interesting one, and requires close investigation by a chemist on the spot. Samples must be taken with great care through a whole season on different types of soil.

CONTROL OF BROWN AND BRONZE BEETLES IN THE ORCHARD.

BROWN and bronze beetles are recognized to be very destructive orchard pests. The latter particularly is on the increase, and during the past season has been responsible for a considerable amount of blemishing of the apple crop. So far no satisfactory method of control has been devised, despite the fact that numerous experiments have been carried out over a number of years. The constitution of this pest is evidently too strong to render it amenable to the orchard arsenical sprays, consequently deterrent sprays at the time of attack suggest the greatest possibility of control. Unfortunately, none of those at present in use has been found to give very much relief.

However, Mr. H. R. John, of Te Teko, Bay of Plenty, claims to have secured a very satisfactory control from the use of Black Leaf 40. Black Leaf is a nicotine specific commonly used in orchard practice, but it has until recently attracted no great amount of attention as a remedy for bronze-beetle. In the course of a letter Mr. John writes—

The grass-grub or brown chafer beetles did not rise here till about the middle of January this year. As soon as they showed themselves on the trees in any number I sprayed with Black Leaf 40, and they left the trees alone altogether. A piece of ground badly affected in previous seasons, and the trees sprayed last year, was dug. On this piece of land only one plum-tree out of six has been attacked at all, and that very slightly. Since I sprayed for the beetle in January I have not noticed any on the trees, the only ones seen being in the ground where dug, and they appear to be dormant. I am convinced that this pest can be controlled greatly here, if not killed altogether, by using the Black Leaf spray.

A closer watch will be kept on the results of Black Leaf 40 elsewhere, in the hope that Mr. John's experience may be confirmed.

—Horticulture Division

OAT-SMUT AND ITS CONTROL.

SURVEY AND EXPERIMENTAL WORK, SEASON 1926-27.

J. C. NEILL, Field Mycologist, Biological Laboratory, Wellington.

FARMERS in the South Island have lost this season approximately half a million bushels of oats—or, at 3s. per bushel, £75,000—solely through failure to disinfect their seed for smut. The statistics tabulated below, which were collected during January and February of this year, show that in Canterbury oat-smut has caused much greater losses than last year, while in Otago and Southland the amount of smut has been greatly reduced. These results may be in part due to seasonal variations in the severity of attack of the disease, but are certainly mainly due to the care or want of care respectively of farmers in the treatment of their seed oats. Certain districts in Otago and Southland which last year suffered very heavy losses show this year a mere trace of smut in the crops, due to the general adoption by the growers of proper methods of seed-disinfection.

In the Wairau Valley, Marlborough, an interesting position in regard to this disease was disclosed by the survey. Last year no smut was detected in the oat crops in this valley, and it is not the custom for growers there to disinfect their seed. Two crops of Algerian oats were, however, examined in the neighbouring Awatere Valley and found to contain a good trace of smutted heads. The seed for these crops had been specially imported from Canterbury to bring into the district a new strain, and, as is customary in Marlborough, had been sown without disinfection. This year twenty-four crops of oats scattered all over the district were found to contain oat-smut, and wherever the seed origin could be traced it was found to have been the product of the infected crops examined in the Awatere Valley the year before, or to have been directly imported from Canterbury. It seems probable, therefore, that unless the farmers of Marlborough disinfect their seed oats, as they do at present their wheat and barley, they will in the future suffer heavy losses through smut, and seriously impair the clean reputation of Marlborough chaff.

Details of this season's oat-smut survey are given in Tables 1 and 2, together with last year's figures for comparison. The methods used in collecting and estimating are the same as those used last year and published in the *Journal* for March, 1926, page 166. For computing the amount of the losses a bushel of oats has been taken as worth 3s. in both years.

PREVENTIVE TREATMENT.

There is only one way to prevent the occurrence of smut in oats, and that is to sow seed free from infection. Naturally smut-free seed is rare, but almost complete disinfection may be obtained with any line, however smutty, by steeping the seed in formalin prior to sowing. This method is cheap—costing about a penny per bushel of seed—simple to apply, and, if properly carried out, will not lower the percentage germination or vigour of the stand. Many farmers still use the bluestone pickle, but this method, while it reduces the smut to

Table 1.—Number and Condition of Oat Crops examined.

District.	Examined.		Clean.	
	1925-26.	1926-27.	1925-26.	1926-27.
Marlborough	12	52	10	28
Canterbury	35	256	18	79
Otago	100	129	12	30
Southland	110	115	11	5

District.	Smutted.					
	Trace to 1 per Cent.		1 per Cent to 20 per Cent.		Above 20 per Cent.	
	1925-26.	1926-27.	1925-26.	1926-27.	1925-26.	1926-27.
Marlborough ..	2	19	..	4	..	1
Canterbury ..	12	82	5	85	..	10
Otago ..	41	65	33	29	14	5
Southland ..	47	68	42	33	10	9

Table 2.—Estimated Losses from Oat-smut.

District.	Crops examined.					
	Area.		Actual Loss.			
	1925-26.	1926-27.	1925-26.	1926-27.	1925-26.	1926-27.
Marlborough ..	Acres. 398	Acres. 1,219	Acres. ..	Acres. 7	Bushels. ..	Bushels. 108
Canterbury ..	1,175	5,901	13.8	201	534	8,844
Otago ..	5,119	2,600	528	50	20,434	2,176
Southland ..	2,362	2,711	157	112	6,076	5,152
Totals ..	9,054	12,440	698.8	370	27,044	16,370

District.	Statistical Estimate.					
	District Area in Oats.		Loss.			
			Quantity.		Value.	
	1925-26.	1926-27.	1925-26.	1926-27.	1925-26.	1926-27.
Marlborough ..	Acres. 15,000	Acres. 15,000	Bushels. ..	Bushels. 2,600	£ ..	£ 390
Canterbury ..	187,000	202,000	84,915	302,465	12,737	45,370
Otago ..	82,000	78,000	326,938	64,500	49,040	9,675
Southland ..	71,000	66,500	182,277	126,380	27,341	18,957
Totals ..	355,000	361,500	594,130	495,945	89,118	74,392

small proportions, most certainly lowers the germinative energy of the seed. An examination of the detailed results of this season's experiments with both methods, which are given in Table 3, shows this clearly; but still more striking was the difference in vigour seen when the plants were growing side by side.

The method of treatment recommended is as follows: In a tin bath, wooden, iron, or concrete trough, or other receptacle, mix the formalin as purchased with water in the proportion of 1 pint of formalin to 30 gallons of water. Do not guess, but measure the quantities accurately, for on their correctness largely depends the success of the treatment. Put half of each sackful of seed oats into another sack, so



FIG. 1. OAT-SMUT.

[Photo by H. Drake.

that the sacks for treatment are not more than half full. Immerse the sacks and grain below the surface of the formalin solution for exactly ten minutes, moving the grain about several times while under. At the end of ten minutes remove the sack from the solution. A good method for this is by means of a block and tackle rigged over the trough, by which the sack can be lifted and left for a while suspended over and draining back into the trough. The sack is then thrown on the ground and the grain flattened out to an even layer within the sack. If the operation is performed in the evening the grain will be fit for sowing the next morning. Do not empty the grain into other sacks unless these have been previously disinfected.

Dipping may be continued in the same solution until the level is too low to cover the sacks, when fresh solution should be added made up in the same proportions—1 pint to 30 gallons of water. A pint bottle of formalin costs 2s. 9d., and it will make enough solution to treat about 35 bushels of oats.

Some farmers obtain satisfactory results by shovelling the grain on the floor while sprinkling the formalin solution over it from a watering-can. If this method is adopted the heap of grain should be covered overnight with sacks soaked in the formalin solution, and the shovelling should be done very thoroughly so as to make sure that every grain is completely wetted by the solution. The steeping method as described is in general safer, both in regard to smut-control and in avoiding damage to the seed, and is at least as easy to carry out, provided a suitable dipping-trough is available.

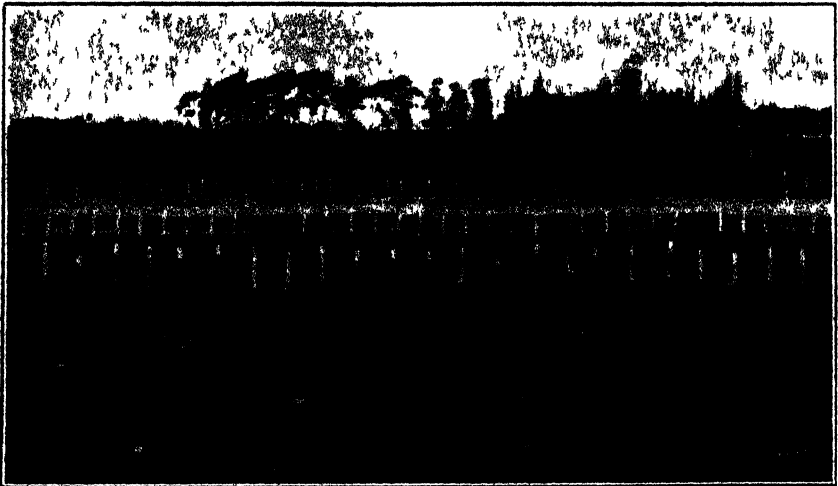


FIG 2 PORTION OF CEREAL SMUTS TRIAL PLOTS AT ASHBURTON EXPERIMENTAL FARM, SEASON 1926 27

[Photo by J. W. Hadfield.]

It will be noticed that the strength of formalin solution recommended has been increased from 1 pint in 40 gallons to 1 pint in 30 gallons. This year's experiments (Table 3) show that the increased strength is quite safe, and is more effective in controlling the smut.

SUMMARY OF EXPERIMENTAL RESULTS.

The experiments on the control of oat-smut were this year confined to the hot-water, bluestone, and formalin methods, last year's work having shown these to be the most effective. Six varieties of oats were used, five of which showed heavy smut-infection in the untreated controls, the sixth (Algerians) remaining clean throughout. A series of samples dipped for ten minutes in water held at temperatures from 121° F. to 141° F. showed that the germinative vigour of the seed was

not impaired up to 137° , and that only with the Sparrowbill sample was there a serious drop in germination at 141° . With the Garton seed (Abundance), which gave 47 per cent. of smut in the controls, no smut appeared at temperatures above 123° . The Sparrowbill, Black Supreme, and Providence varieties showed no smut above 125° , while the Duns gave one smutted plant at 127° and 129° F., but none above that temperature. A gradual increase in tallness of the plants at harvest was apparent in all varieties, as compared with the control rows, through 121° to 133° , this being maintained to 137° , and dropping off to control level again at 141° .

Bluestone (copper sulphate) showed satisfactory results only with the variety Providence, in which it controlled the smut, with a slight improvement in germination over controls. With the other varieties bluestone failed to control the smut, and it impaired the vigour of the seed, so that not only was the total germination less but it was delayed with many of the seeds for several weeks. In the tabular results it will be seen that bluestone alone showed a higher percentage count of mature plants than at the first count, when the majority of the plants were 3 in. to 4 in. high. In addition the bluestone rows looked sickly and yellow compared with the healthy green of the control and formalin rows alongside.

Three strengths of formalin solution were used: 1-240 (1 pint to 30 gallons), 1-320 (1 pint to 40 gallons), and 1-480 (1 pint to 60 gallons), in each of which the seed was dipped for ten minutes and drained, kept moist and covered overnight, and sown on the following day. No significant difference could be detected between the three treatments in regard to germinative vigour, and all three were in general better than the untreated controls. In regard to smut-control, the 1-240 strength completely controlled the smut, except in the Gartons, where one seed escaped disinfection. The 1-320 strength controlled the smut with Duns and Providence, but failed to do so in the other varieties, though the amount was reduced to less than 1 per cent. The 1-480 strength failed to control the smut in any of the varieties.

INTERNATIONAL CONGRESS OF AGRICULTURE, 1927.

THE thirteenth International Congress of Agriculture will be held at Rome from 23rd to 28th May this year. The programme of the congress is divided into six sections, as follows: (1) International Conference of Agricultural Associations; (2) Agricultural Cultivation and Industry; (3) Zootechnics; (4) Training and Co-operation in the Agricultural Industry; (5) Agricultural Geology and Climatology; (6) Women's Section, dealing with women's organizations in rural districts, domestic economy, and the development of rural life. The main topic for discussion in Section 3 will be the problem of the world production of meat and milk from an economic and social standpoint; and that in Section 2 the cultivation of cereals from a similar point of view.

Winton Experimental Farm Pasturage.—Referring to last month's article on top-dressing trials at Winton Experimental Farm, the weeds shown by botanical analysis to be present in the pasture of Block 3 (ranging from 6 to 8 per cent of the herbage) were Scotch thistle, catsear, hawkweed, mouse-eared chickweed, and scarlet pimpernel. In the unlimed strips Yorkshire fog and sweet vernal were also present.

“NATURAL CONTROL” OF WEEDS AND INSECTS BY FUNGI.

G. H. CUNNINGHAM, Mycologist, Biological Laboratory, Wellington.

“NATURAL CONTROL” is a shibboleth that has been much before the public in recent years, owing to the amount of prominence it has been given in the Press. The possibility of eliminating a weed or insect without direct labour or monetary expenditure has an especial appeal to the farmer or orchardist. The writer has of late received increasing numbers of specimens of weeds, insects, and the like, sent in by farmers and others to the Laboratory for examination, which were supposed to be killed by some “natural enemy.”

The possible value of fungi as controllants of weeds and insects has been held in view by the Department of Agriculture for many years; and since the writer commenced his duties as Mycologist in 1919 he has had to carry out much experimental and observational work in this connection. The present article brings together the results of this work.

FUNGI ATTACKING WEEDS.

Canadian Thistle (*Cnicus arvensis*).

A rust, *Puccinia obtegens*, which attacks this plant is perhaps one of the finest examples of the effects of control of any weed by a fungus. This organism has been present in New Zealand to the writer's knowledge for at least forty-six years (for specimens are in his herbarium collected in Canterbury in 1881 by T. Kirk), and is so widespread that it can be found in almost any clump of Canadian thistle. Once a patch becomes infected the disease persists for an indefinite period, and is noticeable for many years. One such clump of diseased thistle the writer noticed first in 1916, on the banks of the Turakina River, Wellington District, and on a visit this season it was found still to be infected. Once the rust becomes established it attacks a proportion of the plants, distorting them and so altering their colour as to render them conspicuous. Such plants fail to set seed (if female), as they usually succumb shortly after flowering. As has been mentioned, the disease is so widespread that scarcely a patch is free from it, whether in Auckland or Southland; yet Canadian thistle is spreading each year. The fact remains that only a proportion of the plants are infected, and although these are prevented from seeding, and usually killed, yet others in the clump reach maturity and produce more than sufficient seed necessary for perpetuation and spread.

The rust may be readily spread artificially; for all one has to do is to select a diseased stem, and, in the late spring during wet weather, thresh healthy plants with it. But even when this is carried out systematically, so that every individual plant in the patch is inoculated, at best not more than about 50 per cent. of the plants show signs of the disease the following season (for it is in the season after inoculation that the disease distorts the plants). This matter has been discussed more fully by A. H. Cockayne (1, 2).

A second disease of Canadian thistle has become noticeable in recent years in certain areas through the North Island. This kills and blackens numbers of stems in certain patches. The writer's attention was drawn to such areas in the Gisborne district in 1922. Specimens were secured, and from these cultures were made and a species of *Fusarium* isolated. This was inoculated into Canadian-thistle plants grown in pots in the Laboratory, and in the majority of cases these were blackened and killed within three weeks. Numerous cultures were prepared and taken to Plimmerton, where patches of Canadian thistle were growing in rich land. Seven of these patches were selected, and a number of plants in each inoculated. In practically all cases the inoculated plants were killed, so that hopes were entertained that a useful controllant of the weed had been secured. Inspection the following year revealed the fact that not one of the inoculated patches showed the presence of the disease. Nor has it shown up subsequently either in these areas or apparently (for it has not since been recorded) in those at Gisborne from which the original material was secured. Stock cultures had been kept, and when the disease did not appear in the inoculated patches further experiments were conducted in the Laboratory with plants in pots. All were uniformly negative, so that at the time the fungus was considered to have lost its pathogenicity through long keeping. Specimens of the same disease have been sent in subsequently on numerous occasions, but, in view of the facts recorded above, further experiments with it have not been conducted.

A third disease of Canadian thistle has occasionally appeared. This disease, caused by the fungus *Sclerotinia sclerotiorum*, is readily noticeable in that it attacks the stem of the plant above ground-level and there produces a canker. The plant is killed, and if the stem is cut open, in the cavity will be found numerous black, shot-like bodies termed sclerotia, which serve to carry the disease from one season to the next, and also to characterize it. This disease has been noted on other weeds, such as spear thistle (*Cnicus lanceolatus*), wing thistle (*Carduus pycnocephalus*), and fennel (*Foeniculum vulgare*), and has proved troublesome on many cultivated flowers, potatoes, tomatoes, peas, beans, Jerusalem artichokes (largely grown for pig-feed), and many others. The writer has records of its occurrence on forty hosts in New Zealand.

In view of the fact that it has proved a serious trouble of cultivated plants, it was considered inadvisable to experiment with this disease. Moreover, it is doubtful if it would prove of any value as a controllant of weeds, for, despite the prevalence of the fungus throughout New Zealand, it has been found but once on each of the four weeds here enumerated as hosts.

Broom (*Cytisus scoparius*).

For the past six years the writer has had under observation a gully near the Biological Laboratory in which there is a dense growth of broom. About 1 per cent. of these plants are dead or dying, and over this period the percentage has not appeared to vary. Examination has shown that the organism killing the plants is *Stereum purpureum*, the cause of silver-leaf of fruit-trees. This has proved one of the most serious diseases attacking fruit-trees in New Zealand (7, p. 284), and is

also often troublesome on poplar, willow, white-birch, oleander, laburnum, lilac, tagasaste, &c. In view of this fact it is surprising that it has done so little damage to the broom in the gully referred to, as conditions are ideal for widespread infection, the plants being very numerous and close, and stock constantly pass through this area, breaking down branches and affording the wounds necessary for entry of the parasite. This is not an isolated case, for, as has been recorded elsewhere (7, p. 292), thousands of infected broom-plants are to be seen on waste land in the Tasman and Mapua districts of Nelson.

Gorse (*Ulex europaeus*).

Very frequently dead gorse-plants may be noted growing among healthy ones, and dead plants of this type are among those most frequently sent to the Laboratory for examination and report. Up to the present only one fungus has been isolated from such material. The work was conducted by Mr. J. C. Neill, Field Mycologist, who inoculated with the organism isolated (the fungus was not identified) seedling gorse-plants grown in pots, but all experiments were negative. Gorse is mentioned here (it being so frequently forwarded for examination) so that in future those interested will recognize the fact that, despite many attempts, only one fungus, and that not pathogenic, has been isolated from it. A satisfactory explanation for the frequent death of these plants is not forthcoming. Frequently examination has shown borer to be responsible; in other cases the plants have been found infested with cottony cushion scale (*Icerya Purchasi*), a pest known to kill this and other plants on occasions; but many other specimens have been examined in which neither borer nor scale was present.

Blackberry (*Rubus fruticosus*).

Owing to its economic importance, careful observations during the past five years have been made of the fungi present on blackberry.

The most outstanding instance of fungous attack upon this host occurred in 1922, and formed the subject of an article by the writer (4). In this instance it was reported in the Press that large areas of blackberry (many hundreds of acres) had been killed outright in Auckland Province. Mr. L. Paynter and the writer made a survey of the Ngawaro, Oropi, Tauranga, Waihi, Te Aroha, and Morrinsville districts, in which the disease was reported to be prevalent. As is usual on such occasions, the areas when examined were found to be small, ranging in extent from a few yards to about an acre.

The organism causing the death of these plants was isolated and found to be *Leptosphaeria Coniothyrium*, the cause of cane-wilt of raspberry. Inoculation experiments showed that, although this disease had killed numbers of plants in the field, it did but slight damage to the plants artificially infected, at best killing a few canes, but generally merely forming lesions on the latter. The following year the disease did not appear to do any damage in those areas where it was prevalent the previous season; and from that date it has not been reported as being of any moment. It is abundant on blackberry throughout New Zealand.

A second disease noted on the survey tour in 1922, and commented on in the same article, was a fruit-rot caused by the fungus *Rhizopus arrhizus*. Under favourable conditions this organism destroys most of the fruiting panicles of a plant indeed, in one instance it was found to have destroyed most panicles over a considerable area in a swamp at Inglewood, Taranaki. Mr. R. Waters, Officer in Charge of the Biological Laboratory, recently brought in numerous specimens of these infected fruiting panicles. They were handed to Mr. N. R. Foy, Seed Analyst, who found that approximately only 1 per cent. of the seed from such panicles had matured an embryo. Thus it is seen that this disease under favourable conditions may almost completely destroy the seed. Unfortunately, these conditions are not readily attained, for it has been proved experimentally that this fungus attacks only overripe fruit, or fruit which has been injured in some manner. Further, it is essentially an organism which usually thrives only where the atmospheric humidity is high.

A third disease of blackberry abundant in New Zealand is leaf-spot, caused by the fungus *Septoria Rubi*. This produces spots on the leaves, but appears to have little detrimental effect on the host, as it is abundant wherever this plant occurs.

A fourth disease is caused by the rust *Kuchncola albida*, also common in most localities on blackberry. It attacks leaves and stems, but, apart from stunting the plant somewhat, does little damage.

The possibility of introducing fungous diseases of blackberry and related species of *Rubus* from abroad with a view to utilizing them as controllants has also been considered. Letters were sent to approximately fifty mycologists throughout the world, requesting information relative to any disease on *Rubus* spp., and that where any of these showed promise of being actively parasitic specimens and cultures should be supplied. Most replied that apart from such diseases as cane-wilt and leaf-spot, which were already present in New Zealand—no diseases of any significance were present, a few regretted their inability to supply material; and three forwarded specimens. Dr. Pethybridge, England, forwarded viable material of the rust *Phragmidium violaceum* on blackberry, Dr. B. O. Dodge, Washington, D.C., U.S.A., forwarded the rust *Gymnoconia Peckiana* and Dr. A. Sharples, Straits Settlements, forwarded cultures of three fungi from *Rubus* spp. All inoculations—which have been carried out over a period of twelve months—proved negative, save with the cultures from Dr. Sharples, which have given inconclusive and unsatisfactory results.

Bracken Fern (*Pteridium esculentum*) and **Hard Fern** (*Poa scaberula*).

In 1919 Mr. E. Bruce Levy, Agrostologist, brought the writer abundant material of bracken which had apparently been killed by some disease. Cultures were made and a species of *Fusarium* isolated. This was inoculated into bracken-plants kept in pots in the Laboratory, but with negative results. Further inoculations were made into plants growing on the edge of a roadside near Weraroa—these also were negative. It was thought that if inoculations were carried out in the locality where Mr. Levy obtained the material better results might be obtained; consequently cultures were taken to Marton and seventeen

plants inoculated. Of these at a later inspection five were found to be dead, and the *Fusarium* was again isolated from the killed rhizomes. The following season an examination of the areas was made, but no dead plants could be found, nor have such appeared since.

Specimens since received from correspondents have sometimes yielded this same *Fusarium*, but more frequently no fungus has been isolated. In view of the indifferent results secured, further experiments with the *Fusarium* have not been undertaken.

Several times in recent years Mr. Levy has brought to the Laboratory specimens of hard fern apparently killed by some disease. This plant grows in patches, and in the centres of these areas frequently occur numerous dead plants. Among these, grasses usually become successfully established. Consequently Mr. Levy thought the possibility of securing a pathogen to kill similar areas on the class of country on which he had been working at Whangamomona would prove of considerable value. Unfortunately, up to the present no fungus or bacterium has been isolated from this hard-fern material.

Goat's-rue (*Galega officinalis*).

In 1919 Mr. J. Fleming, Stock Inspector at Palmerston North, brought to the writer diseased specimens of goat's-rue, which he found to be not uncommon on the banks of the Manawatu River at Palmerston North. The stems had been attacked at ground-level and destroyed, with the result that the plants had been killed.

Isolations were made and a fungus, *Phoma Galegae*, isolated. (Cultures inoculated into young plants in pots were positive, the latter being killed in three weeks. Inoculations in the field were undertaken in the vicinity of the bridge at Palmerston North. Owing to the fact that the writer moved very shortly afterwards to Weraroa, the results were not followed up, but inspection of the area made six months later showed a number of dead plants. The disease did not appear to have spread, however, for no recently infected plants were found. The disease has subsequently been noted on several occasions on the river-banks, isolated plants being affected; but in no instance can the disease be said to have proved instrumental in controlling the growth of goat's-rue in this region.

Tauhinu (*Cassinia leptophylla*).

In 1926 Mr. H. McDonald, Levin, reported to the Department of Agriculture that a disease appeared to be killing tauhinu on his property at Weraroa. The writer visited the area with Mr. McDonald and found a considerable number of dead and dying plants. Examination of infected plants showed they were being attacked by a wound parasite which penetrated through injuries formed as a result of the wind splitting branches at the crutches. Very many plants were examined, and on severely infected and dead plants numerous fructifications of one of the shelf-fungi were secured. These were sent to the Kew Herbarium for examination. Miss Wakefield, Mycologist at Kew, reported that the fungus resembled in general structure and spores resupinate forms of *Fomes ignarius*, but considered the colour of the flesh was not quite the same. No infection experiments with this

organism were undertaken, for the writer was informed that it was intended to use the organism commercially for the control of tauhinu.

Numerous other fungous diseases of weeds occur in New Zealand, but sufficient has been written to indicate that with our present knowledge it is not possible to destroy on a large scale any of the weeds listed by those fungi found attacking them. Sometimes in nature the severity of attack amounts to a local epidemic, but even were conditions governing such a severe attack known it is highly improbable that they could be artificially created over any extensive area.

FUNGI ATTACKING INSECTS.

Entomogenous fungi have been used for many years in the control of insects in the citrus-groves of Florida. Knowledge of this fact has led the writer to interest himself in this group.

Numerous instances of fungi attacking insects can be cited: For example, the well-known "vegetable caterpillars," which are not vegetables but larvæ of species of moths which have been parasitized by certain fungi; house-flies attached to a window-pane in the late autumn and surrounded by a "halo" of spores of the fungus *Empusa Muscarum*; scale insects on leaves in the forest so altered as to be unrecognizable, &c.

One such fungus (*Cephalosporium Lecanii*) has been known for the past few years to attack the brown scale (*Saissetia oleae*) in citrus-groves in the Auckland District. In fact, in certain seasons this fungus has become so widespread that it has frequently been difficult to find a scale not parasitized. Naturally, orchardists have been impressed with its value as a controllant of brown scale, and many inquiries have been made as to the best method of propagating it.

More recently Mr. Everett, Orchard Instructor, has forwarded from Tauranga another species (*Sphaerostilbe auranticola*) attacking red scale of citrus (*Chrysomphalus aurantii*). This organism also was abundant on all the scales on the specimen forwarded.

That such fungi should be used in the control of these scales seems practicable, and, as indicated, they are used for this purpose in Florida groves. Unfortunately, New Zealand experience has shown that they are unreliable, in that one season they may practically exterminate the scale in a locality, yet in the next may scarcely or not at all check the spread of these pests.

Experience elsewhere has been similar, for Mr. T. Petch (8), the world's authority to-day on this group of fungi, in a presidential address before the British Mycological Society in 1921, summarized the position as follows:—

At the present day, after thirty years' trial, there is no instance of the successful control of any insect by means of fungous parasites. If entomogenous fungi already exist in a given area, practically no artificial method of increasing their efficacy is possible. If they are not present, good may result from their introduction if local conditions are favourable to their growth, but, on the other hand, their absence would appear to indicate unfavourable conditions. It would seem that a fungus makes little progress until the insects are excessively numerous, either locally or generally, when for reasons not known an epidemic of fungous disease breaks out. And in this connection it may be noted that the apparently successful experiments in inducing a more rapid dissemination of an entomogenous fungus have usually been made during such an epidemic . . . The problem

which has yet to be solved by those who wish to control insects by means of fungi is how to create an epidemic at a time when such an epidemic would not occur naturally. The evidence indicates that it is not possible to accomplish that by the mere introduction of the fungus or by spraying spores from material or artificial cultures. The solution of the problem probably depends in each case upon a study of the bionomics of the insect.

This statement, from one so well qualified to discuss the subject, shows that at present the grower would be well advised to ignore attempts at control of citrus scale by the use of entomogenous fungi, and to rely upon the sprays recommended for the purpose.

Vast numbers of larvæ of insects are destroyed annually by the so-called "vegetable caterpillars." These fungi parasitize and replace the tissues of their hosts with a compacted web of mycelium. No less than six species are present in New Zealand (3, 5) — namely, *Isaria Sinclairii* (Berk.) T. Petch, on specimens of cicada, *Melampsalta cingulata* Fabr. and *M. cruentata* Fabr.; *Cordyceps Craigii* Lloyd, *C. consumpta* G. H. Cunn., and *C. Robertsii* Hook., on larvæ of *Porina* spp. (subterranean grass-caterpillars); *C. Aemonae* Lloyd, on the larvæ of *Acmona hirta* Fabr. (flat-headed lemon-tree borer); and *C. Kirkii* G. H. Cunn., on *Deinacrida rugosa* Buller (Stephen Island weta). Some of these fungi are rare, but others — e.g., *Cordyceps Robertsii* (the common "vegetable caterpillar") — are abundant and collected in their hundreds in certain localities such as Mount Egmont and the Rotorua district.

Flies parasitized by a fungus, *Empusa Muscae*, are familiar to all in late autumn in dwellings, yet flies appear as abundant as ever the following season.

A fungus, a Phycomycete, species unknown, was in 1919 at Weraoia found to have almost exterminated the larvæ of diamond-back moth (*Plutella maculipennis*) attacking the swede crops on the Central Development Farm. This proved so promising that field observations over a period were carried out. On all the hundreds of leaves examined numerous larvæ were present, but in all cases these were found to be parasitized. The fungus was isolated by Mr. R. Waters, but, as living larvæ could not be obtained (so widespread had the parasite become), he was not able to carry out inoculation experiments. The following season observations made on the farm and in the district showed that, although the diamond-back moth was abundant, traces only of the parasite were present; nor has it been observed to be prevalent subsequently in any part of New Zealand, though examinations have been conducted each year.

In 1923 Mr. D. Miller, Entomologist, brought the writer numerous specimens of codlin-moth (*Cydia pomonella*) larvæ from Canterbury parasitized by a species of fungus. Only the *Isarial* form was present, and identification was thus not possible. So abundant was this parasite that Mr. Miller had difficulty in obtaining unaffected larvæ. Nevertheless codlin-moth was as troublesome as ever the following season.

These facts bring home forcibly the truth of Mr. Petch's remarks. We know so little at present regarding that balance between casual parasitism and extermination of any one host by its parasite that, until the conditions governing such can be worked out and controlled, control of insect pests by fungi must be regarded as possessing practically no value.

FUNGI ATTACKING FUNGI.

Even fungi have their parasites, as is well known by the very numerous examples which have been recorded at intervals in mycological literature. A few examples must here suffice. One frequently finds present in the uredosori of many of the rusts the fungus *Darluca filum*. This parasite destroys the uredospores, and also on occasion attacks in addition aecidiospores and teleutospores. So widespread is this parasite that we frequently have difficulty in securing specimens free from it. In a recent paper (6) the writer has recorded it as being found on no less than twenty-eight species, and it appears to be equally abundant throughout the world. It might be expected that such a parasite would be of material value in checking the spread of many of these rusts. Unfortunately, such is not the case, for examination of any rust pustule shows that as a rule a small proportion only of the spores have been destroyed, this number being usually in the vicinity of 1 per cent., and seldom more than 5 per cent.

Other parasites of a similar type have been noticed in New Zealand from time to time, such as *Cicinnobolus Cesatii*, on powdery-mildew of the apple; *Tuberculina persicina*, on certain rusts; and a *Fusarium* (unidentified), on the uredosori of acacia gall-fungus (*Uromycladium notabile*). But in no instance have they proved of any value in checking the spread of these diseases.

CONCLUSION.

From the foregoing data, collected during the past eight years, dealing with numerous diseases of weeds and insects under varying climatic and soil conditions, only one conclusion can be drawn—namely, that with our present knowledge and technique it is not possible to use in the economic control of weeds and insects fungi which occasionally attack them under natural conditions. This is to be regretted, for such a method of control would have proved of inestimable value, especially in those areas and on those properties where the labour of eradication by hand is too costly.

The evidence produced indicates that it is but a waste of time to proceed with experiments along these lines. It also presents the fact that the Department of Agriculture has for many years given attention to the investigation of any such possible methods of weed or insect control.

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LIMING AND PHOSPHATE TOP-DRESSING EXPERIMENTS ON PASTURE IN CANTERBURY, 1924-25-26.

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In the July, 1925, issue of the *Journal* the results of an experiment on the top-dressing of pasture on the farm of H. E. Peryman and Sons, Tai Tapu, were recorded and discussed. The paddock was sown down in September, 1923, with 30 lb. perennial rye-grass and 6 lb. white clover per acre. Phosphates in the form of superphosphate and basic super caused increases of about $1\frac{1}{2}$ tons of hay per acre, their application being highly profitable. As a result of the very large increases the questions which suggested themselves were: (1) Would the phosphates have any further effect in the following season? (2) Would a further application be justified? (3) How would the application in 1925 affect the control plots of the previous year?

To test these points the plots were crossed with ten replications of super and control plots. These strips were half a chain wide and alternated with each other. Hence, wherever a control of the 1925 season fell the treatments of the previous season remained. Where the super of 1925 crossed the manured plots of the previous season, phosphates had been applied for two successive seasons, and where the super of 1925 crossed a control of the previous season the effect of super applied in 1925 could be measured.

The manures used in the 1924-25 season were as follows, all weights being per acre: (1) Superphosphate (42/44), 2 cwt.; (2) superphosphate (42/44), 2 cwt., plus dried blood, $\frac{1}{2}$ cwt.; (3) basic super (40/43), 2 cwt.; (4) basic super (40/43), 2 cwt., plus dried blood, $\frac{1}{2}$ cwt. The blood caused no increase, and in measuring the effect of the manures in the second season both phosphate and phosphate-plus-blood plots were regarded as phosphate plots. It was assumed that the small amount of blood would have no effect in the second season after application. The 1925 application of 2 cwt. super per acre was made on 10th July, and the area visited on 15th October, when the effect of this treatment was apparent on account of the greater development on clover. The manured plots of 1924-25 were not distinguishable with certainty. Waterlogged patches were much in evidence, and on these there was practically no growth. The crop was cut and weighed on 14th December, and the weights recorded in Table 1 are of the green weight of material. About one-third of these would represent hay weights.

Comments on Table 1.

(1) Super, which caused the highly profitable increase of $1\frac{1}{2}$ tons of hay per acre in 1924, has given a further increase of over 1 ton of green material, equal to about $\frac{1}{2}$ ton of hay, in the second season after application.

(2) Basic super has also caused a further increase.

(3) The application of super in 1925 to plots not previously treated (*i.e.*, controls of year 1924 plots) shows an increase in one crop of $2\frac{1}{2}$ tons of green material, or about 16 cwt. of hay.

Table 1.
Area of individual weighed plot = $2\frac{1}{4}$ acre.

Comparison A <i>versus</i> B.	Number of Paired Plots.	Green Weight in Tons per Acre.		Difference Significant or Non-significant *
		Yield.	Difference in Favour of A.	
A. Super (applied 1924)	30	5.9	1.1	S.
B. Control .. ..	..	4.8	..	..
A. Basic super (applied 1924)	25	5.7	0.7	S.
B. Control .. ..	..	5.0	..	..
A. Super (applied 1925)	53	7.3	2.5	S.
B. Control .. ..	..	4.8	..	..
A. Manure, irrespective of kind (applied 1924), plus super (applied 1925)	121	7.3	1.7	S.
B. Manure (applied 1924)	..	5.6	..	..

* A difference is regarded as "significant" only when the chances are 30 to 1 or more in its favour.

(4) Although the manures of the first season's application were still having a beneficial effect on yield, the application of an additional 2 cwt. of super caused a further increase of 1.7 tons of green material (about 9 cwt. of hay). This must be regarded as highly profitable, as the margin of profit after charging the cost of super against the one crop is about 30s. per acre (hay at £5 per ton, super at 7s. per hundredweight).

The area was visited in July of the year, and the greater palatability of the phosphated plots was evident by the close grazing of these as compared with controls.

LIMING AND PHOSPHATE (SUPER) TOP-DRESSING.

With the object of acquiring information regarding the behaviour of lime alone, super alone, and lime plus super on as many types of soil as possible, a series of trials was commenced in 1924. Ground limestone (carbonate of lime) at the rate of 1 ton per acre, and superphosphate (42/44) at the rate of 2 cwt. per acre, were used. The arrangement of plots was as follows: (1) Lime (1 ton carbonate); (2) control; (3) superphosphate (42/44), 2 cwt. per acre; (4) lime, 1 ton, plus super, 2 cwt., per acre; (5) control; (6) lime, (7) super; (8) control; (9) lime plus super. This represents only half the number of plots used, so that it will be seen that there are four replications of each treatment and six replications of controls. The width of each plot is equal to from two to four widths of the machine used in top-dressing, varying, therefore, from about 16 ft. to 32 ft. on the different areas.

A number of weighings were taken from each strip, and weighings on treated plots compared with neighbouring weighings on controls. The material was weighed in the green state, and the percentage of hay found as described in the *Journal* for June, 1925 ("Pasture Top-dressing Experiment in Canterbury; Ward and Hudson").

1. Experiment on Farm of Mrs. Thomson, Spotswood.

Soil : Loam, showing a lime-requirement of about 2 tons per acre. (NOTE.—Where lime-requirement and type of soil are shown, these are taken from a report of the Department's Chemist on samples sent for examination.) Flat country at foot of downs.

History of paddock : Sown down in November, 1922, with 30 lb. perennial rye-grass and 5 lb. red clover. Lime applied, 4th June, 1924 ; super applied, 4th August. Hay crop weighed, 5th December.

Observations during growth : The plots receiving super were conspicuous by their greater development of red clover. No effect due to lime could be seen. In March, 1925, about three months after the hay crop was weighed, the area was stocked with sheep, which showed a marked partiality for the super plots.

Results of weighings are shown in the following table :—

Table 2.

Hay equals 33·5 per cent. of green weight. Area of individual weighed plot = $\frac{3}{4}$ acre.

Comparison A versus B.	Number of Paired Plots.	Hay in Tons per Acre.		Difference Significant or Non-significant.	Profit or Loss per Acre measured by Effect on First Crop of Hay (Hay £5 per Ton)
		Yield.	Difference in Favour of A.		
A. Lime ..	48	1·9	0·1	S.	Loss, 12s. 6d
B Control ..	..	1·8	..	..
A. Super ..	48	2·2	0·5	S	Profit, £1 16s
B Control ..	..	1·7	..	..
A Lime plus super	48	2·05	0·35	S	
B Control ..	..	1·7	..	..

Comments on Table 2.

(1) The extremely small increase of 2 cwt. per acre due to lime is not profitable, and unless the lime has a considerably prolonged and increased beneficial effect its use in this case cannot be considered as being of great benefit. (The measurement of yields in 1926—third season after application—shows that the lime has had a prolonged and increased effect. These results will be published as soon as possible.)

(2) The increase of $\frac{1}{2}$ ton of hay brought about by the application of super is highly paying.

(3) The lime and super combination shows no better result than super alone ; hence its application has reduced the profit from the super.

2. Farm of E. Ayrton, Domett.

Soil : Loam, very similar in situation to that of Experiment A, but rather wetter. Lime-requirement, 30 cwt. per acre. History of paddock : Sown down, 1918, with mixture of perennial rye-grass, crested dogtail, and red clover.

Lime applied, 10th June, 1924 ; super applied, at 300 lb. per acre, 26th August, 1924. Plots weighed on 3rd and 4th December. As far

as could be determined by observation, none of the treatments had any effect. The results of weighing are tabulated as follows:—

Table 3.

Hay = 32.2 per cent. of green weight. Area of individual weighed plot = $\frac{1}{7}$ acre

Comparison A versus B.	Number of Paired Plots.	Hay in Tons per Acre.		Significant or Non-significant
		Yield	Difference in Favour of A	
A. Lime	39	1.7	..	..
B. Control .. ..	..	1.7	..	..
A. Super	39	1.8	..	..
B. Control .. ..	..	1.8	..	..
A. Lime and super	39	1.85	0.08	S.
B. Control .. ..	..	1.77	..	..

Comments on Table 3.

(1) Neither lime nor super had the slightest effect on yield.

(2) Lime plus super gave the very small increase of just over $1\frac{1}{2}$ cwt. of hay per acre. This area was extremely uniform, and in measurement of differences a high degree of precision was obtained.

It was hoped that the foregoing experiments could be followed up in the 1925 season, but the absence of feed in the spring and the small amount of subsequent growth prevented the farmers concerned from closing their paddocks for hay.

3. Farm of A. G. Harrison, Spotswood.

Soil : Loam ; downs country, only two or three miles from location of Experiment 1. Lime - requirement, 2 tons per acre. History of paddock : Sown in 1921 with 40 lb perennial rye-grass and 5 lb. mixed red and white clovers.

Lime applied, 4th June, 1924 ; super applied, 5th August, 1924. Cut and weighed, 12th December, 1924

Observations during growth : All treated plots showed a marked increase in growth of white clover and suckling-clover. The lime-plus-super plots were particularly outstanding in this respect. On 12th March—three months after cutting for hay—the paddock was being stocked with sheep, and so much closer was the grazing on the lime and lime-plus-super plots that a distinct line of demarcation between these and their adjacent controls could be seen the whole length of the paddock, a matter of some 12 chains. All plots receiving lime had marked increase in white-clover growth. In a few places only was the effect of super alone apparent in this respect.

Determination of percentage hay : In view of the preponderance of the clovers on the lime and lime-plus-super plots, it seemed likely that the loss of moisture in drying would be greater on these than on the control plots ; hence separate sets of samples were taken from control

and lime - plus - super plots. The percentages of hay, calculated as described in the June, 1925, *Journal*, resulted: Control, 30.7 per cent., and lime plus super, 22.6 per cent., of green weight. Consequently green weights of plots are shown in Table 4, and hay weights only for lime plus super and controls with which they are compared.

Table 4.

Area of individual weighed plot = $\frac{1}{25}$ acre.

Comparison A <i>versus</i> B.				Green Weight in Tons per Acre.		Significant or Non-significant.
				Number of Paired Plots.	Yield.		Difference in Favour of A.
A. Lime	..	..	48	2.4	0.7	S.
B. Control	..	..	..	1.7	..	
A. Super	..	..	48	2.5	0.8	S.
B. Control	..	..	..	1.7	..	
A. Lime plus super	..	..	48	3.8	1.9	S.
B. Control	..	..	..	1.9	..	
<i>Hay Weight.</i>						
A. Lime plus super	..	..	48	0.86*	0.26	S.
B. Control	..	..	..	0.6†	..	

* 22.6 per cent. of green weight.

† 30.7 per cent. of green weight.

Comments on Table 4.

All treatments have given highly significant increases, that of lime plus super being practically a 100-per-cent. increment in green weight. It will be seen from the lower part of the table that this represents only $\frac{1}{4}$ ton of hay, which at £5 per ton is worth only 25s., against which must be charged the cost of the lime and super, 36s. 6d. The continued effect of the lime and lime-plus-super treatments could leave no doubt in the mind of an observer as to their economical use. It seems practically certain also that the application of super alone was profitable.

Unfortunately, the wetness of the season prevented the hay which had been raked into rows from being carted, and the presence of the heaps produced such variation as to make it difficult to carry out further exact work. The effect of the lime on subsequent crops is being closely watched by Mr. Harrison.

4. Farm of A. McGiffert, Mina.

Soil: Loam. Downs country similar to that of Mr. Harrison (Experiment 3). Lime-requirement, $2\frac{1}{2}$ tons per acre. History of paddock: Sown in October, 1920, with 20 lb. perennial rye-grass, 10 lb. Italian rye-grass, and 3 lb. red clover.

Lime applied, 5th July, 1924; super applied, early August, 1924. Crop weighed, 4th December, 1924.

Observations: The lime-plus-super plots were particularly outstanding on account of the clover-growth. Those having lime alone and

super alone were hardly distinguishable from the controls. On 12th March the area, then being closed up for the production of clover-seed, was visited. Both lime and lime-plus-super plots showed such a marked superiority in growth and amount of clover that it was estimated their yield would be about twice that of the controls. The super plots were not distinguishable from controls.

As with trials on Peryman Bros.' farm and Experiments 1 and 2, the plots of the first season were crossed in the following winter by alternating $\frac{1}{2}$ -chain-wide strips of super (2 cwt. per acre) and control. The super was applied on 23rd July, 1925, and the subsequent crop harvested on 18th December, 1925. The lime and lime-and-super plots were still outstanding on account of greater amount of growth, perennial rye-grass being the main constituent. The clover had almost disappeared. As far as could be observed the super alone was having no effect. The results for the two seasons (one crop in each) are shown in the following table:—

Table 5.

		Season 1924 Crop				Season 1925 Crop			
		Hay = 31.8 per Cent. of Green Weight				Hay = 45.2 per Cent. of Green Weight.			
		Area of Individual Weighed Plot, $\frac{1}{2}$ Acre				Area of Individual Weighed Plot, $\frac{1}{2}$ Acre.			
Comparison A versus B.		Hay in Tons per Acre.			Significant or Non-significant	Hay in Tons per Acre			Significant or Non-significant.
		Number of Paired Plots.	Yield	Difference in Favour of A		Number of Paired Plots.	Yield	Difference in Favour of A	
A. Lime	..	32	0.87	0.15	S.	25	0.65	0.15	S.
B. Control	..	..	0.72	..	..	..	0.50	..	..
A. Super	..	32	0.80	0.06	N.S.	20	0.57	0.03	N.S.
B. Control	..	..	0.74	..	..	..	0.54	..	..
A. Lime plus super	32	1.10	0.40	S.	20	0.80	0.35	S.	
B. Control	..	..	0.70	..	..	..	0.45	..	..
A. Super applied 1925	..	..	..	..	..	78	0.60	0.10	S.
B. Control	..	..	..	..	..	..	0.50	..	..
A. Lime 1924 plus super 1925	..	..	..	..	..	54	0.70	0.10	S.
B. Lime 1924	..	..	..	..	..	..	0.60	..	..
A. Lime plus super 1924 plus super 1925	..	..	..	..	..	53	0.86	0.05	N.S.
B. Lime plus super 1924	..	..	..	..	..	..	0.81	..	..
A. Super 1924 plus super 1925	..	..	..	..	..	54	0.65	0.06	S.
B. Super 1924	..	..	..	..	..	..	0.59	..	..

Comments on Table 5.

In this case there can be no doubt regarding the validity of the claim that the increases shown in one crop represent only about one-half (or probably less) of the total benefit for the season. The weights indicate the lightness of the crop, which makes the fact of profitable increases from certain treatments the more striking.

(1) The increase due to lime of 3 cwt. of hay per acre in each of the two seasons indicates that its effect is likely to extend over a considerable period of time, and in spite of the general falling-off in yield in the second season there is no apparent diminution in the increase due to the treatment. If the increase shown is doubled it is evident that the profit shown would increase considerably, approaching the sum of £2 per acre for the two seasons. For example, if increase is 6 cwt. and worth £5 per ton the net profit would be 30s. less 22s. 6d., cost of lime per acre; hence the profit equals 7s. 6d. But if the increase is really 12 cwt. the profit would be £3 less 22s. 6d., or £1 17s. 6d. The application of lime to this type of land is undoubtedly payable.

(2) The extremely small increases due to the application of super are not significant, and even if significant could not be regarded as being very profitable.

(3) The combination of lime and super gives results which leave no doubt as to their value, and to get good results from phosphatic treatment it would appear that on this land it must be applied to limed ground. The profit as measured by the increases shown in the table is about £1 7s 6d. per acre.

(4) The super which was applied in 1925 shows a small significant increase of 2 cwt. per acre. This in itself is barely payable, but if the fertilizer is of further benefit a small profit should result.

(5) The marked benefit derived from the lime-and-super combination, as shown, would lead to the expectation of a greater increase than 2 cwt. of hay per acre, brought about by the application of super in 1925 to those plots limed in 1924. The super has done no better than when applied to the controls of 1924, and the statement in comment 3 would appear incorrect. The apparent discrepancies are difficult to explain, but *may* be due to the fact that in the 1924 season super was applied to newly limed ground, while by 1925 the lime had been on the ground for just over a year.

(6) Super applied in 1925 to plots receiving lime and super in 1924 gave only a small statistically insignificant increase of 1 cwt. of hay per acre. The chances as calculated (20 to 1) approach accepted certainty, but the increase, if a real one, is not sufficient to warrant the application of the second lot of super.

(7) Super applied in 1925 to these plots receiving super in 1924 shows a significant increase of just over 1 cwt. of hay. The doubling of this increase does not give sufficient to make the application profitable.

Experiments 1, 2, 3, and 4 were conducted in the Cheviot district, being on an approximately straight line of ten miles from Domett to Spotswood. An excellent illustration of the diversity of results occurring over a comparatively small range of country is provided. Only from a large amount of data can generalizations be made.

5. Farm of F. W. Carpenter, Prebbleton.

Soil : Silty loam ; lime-requirement, 3·2 tons per acre ; flat plains land, fairly representative of medium - class wheatgrowing country. History of paddock : Sown in wheat in spring of 1921 with 20 lb. perennial rye-grass and 5 lb. red clover. The experiment was commenced in 1924, being similar in lay-out to Nos. 1 to 4, and was crossed in 1925 with alternating $\frac{1}{2}$ -chain strips of super and control.

Lime applied, 17th June, 1924 ; super applied, 11th August, 1924. In the first season two crops were weighed, the first on 8th December, 1924, the second on 19th February, 1925. The application of super across the plots of the first season was made on 9th July, 1925, and one crop harvested on 17th December.

Observations during growth : Only in the early spring of the first season could differences be detected. A very slight superiority of the red-clover growth was apparent on all treated plots. The results for the first season are shown in Table 6, and those for the second season in Table 7.

Table 6.

Area of individual weighed plot = $1\frac{1}{7}$ acre.

Comparison A versus B.		First Crop, 1924-25 Season (Hay = 33·7 per Cent. of Green Weight)					Second Crop, 1924-25 Season (Hay = 29·5 per Cent. of Green Weight.)				
		Number of Paired Plots	Hay in Tons per Acre		Significant or Non-significant	Number of Paired Plots	Hay in Tons per Acre		Significant or Non-significant.		
			Yield	Difference in Favour of A			Yield	Difference in Favour of A			
A. Lime	..	48	1·4	0·1	S.	45	0·80	0·05	N.S		
B. Control	..	..	1·3	..	..	..	0·75	..	..
A. Super	..	48	1·4	0·1	S.	46	0·75	0·03	N.S		
B. Control	..	..	1·3	..	..	..	0·72	..	..
A. Lime plus super	48	1·6	0·2	S.	48	0·81	0·07	S			
B. Control	..	..	1·4	..	..	..	0·74	..	..

Comments on Table 6.

(1) Lime in the first crop of the growing season following application caused a slight but certain increase of 2 cwt. of hay per acre. No statistically significant difference between lime and control occurred in the second crop.

(2) Super gave an increase equal to that of the lime in the first crop, but no appreciable effect in the second.

(3) Lime and super showed a certain increase of 4 cwt. in the first crop and nearly $1\frac{1}{2}$ cwt. in the second (see further discussion after Table 7).

Table 7 (One Crop, 1925-26 Season).

Hay = 36.49 per cent. of green weight. Area of individual weighed plot = $\frac{1}{100}$ acre.

Comparison A versus B.	Number of Paired Plots.	Hay in Tons per Acre.		Significant or Non-significant.
		Yield.	Difference in Favour of A.	
A. Lime applied 1924	20	0.87	0.24	S.
B. Control .. ..	..	0.63	..	..
A. Super 1924	20	0.71	0.06	N.S.
B. Control .. ..	..	0.65	..	..
A. Lime plus super 1924	20	0.93	0.25	S.
B. Control .. ..	..	0.68	..	..
A. Super 1925	30	0.66	0.02	N.S.
B. Control .. ..	..	0.64	..	..
A. Lime 1924 plus super 1925 ..	30	0.90	0.04	N.S.
B. Lime 1924 .. ..	..	0.86	..	..
A. Super 1924 plus super 1925 ..	36	0.69	..	..
B. Super 1924 .. ..	..	0.69	..	..
A. Lime plus super 1924 plus super 1925 ..	36	0.96	0.04	N.S.
B. Lime plus super 1924 .. ..	..	0.92	..	..

Comments on Table 7.

The first hay crop from which weighings were taken in the 1925 season was considerably lighter than the corresponding crop of the previous season.

(1) Lime shows an increase of about $\frac{1}{4}$ ton of hay. This, coupled with the effect of the lime in the previous year, shows a total increase of 0.34 or practically $\frac{1}{3}$ ton per acre. At £5 per ton this increase is worth approximately £1 13s., and after deducting the cost of lime (22s. 6d. per ton) a profit of 10s. 6d. per acre is shown. It is interesting to note that the increase in the second season is greater than that of the first, and it seems reasonable to suppose that continued benefit is likely to be derived from the lime. Hence a considerable financial benefit is expected.

(2) Superphosphate applied in 1924 does not show any significant increase in the 1925 hay crop. The certain increase in the first crop of 1924 is one of only 2 cwt. per acre. The super has not proved definitely profitable.

(3) Lime plus super of 1924 application shows a further beneficial effect to the extent of $\frac{1}{4}$ ton of hay in the 1925-26 season. Added to the increase shown in Table 6 of 0.2 plus 0.07, the total increase is just over $\frac{1}{2}$ ton. If this is worth £2 10s., the profit resulting is this amount less about 36s. 6d. for lime and super, the net amount being 13s. 6d. Hence the lime-and-super application has been a little more profitable than lime alone. The same remarks regarding further effect as applied to lime will hold also in this case.

(4) The application of super in 1925 to (a) previously untreated ground, (b) previously limed ground, (c) previously super-treated ground, and (d) previously lime-and-super-treated ground has in no case shown a significant increase in the first hay crop taken after application.

6. Farm of J. H. Tobeck, Tai Tapu.

Soil: Rich silty loam, situated about half a mile from the area on which Peryman Bros.' experiment was conducted. Evidence already obtained leaves no doubt regarding the value of phosphates in this locality, but no information regarding the behaviour of lime was available. Consequently an experiment similar to those already described was conducted on this farm, some ten replications of treated plots being made.

History of paddock: Sown in 1919 with Italian rye-grass and red clover. A hay crop and one of red clover for seed have been taken off the paddock each year since sowing down.

In the spring of 1924 the whole of the paddock was top-dressed by Mr. Tobeck with 2 cwt. of super per acre, with most excellent results. For the experiment here recorded, lime (carbonate) was applied on 20th July at the rate of 25 cwt., and super at $2\frac{1}{2}$ cwt. per acre on 17th July, 1925. The crop was cut and weighed on 10th December, 1925.

Observations during growth: No beneficial effects due to the treatment were apparent prior to the cutting of the crop. On 7th July, 1926, the area was inspected, and most of the super and lime-plus-super plots were distinguishable throughout their length owing to their being more closely grazed than the lime and control plots. As the lime plots did not differ from the controls in this respect the effect on palatability must be attributed to the super. The results of weighing of the one crop are as under:—

Table 8.

Hay = 20% per cent. of green weight. Area of individual weighed plot = $\frac{1}{4}$ acre.

Comparison A versus B			Number of Paired Plots	Hay in Tons per Acre		Significant or Non-significant?
				Yield	Difference in Favour of A	
A. Control	..	..	53	2.50	0.05	N.S.
B. Lime	..	..	..	2.45	..	..
A. Super	..	..	61	2.80	0.30	S.
B. Control	..	..	..	2.50	..	..
A. Lime plus super	..	..	60	2.70	0.17	S.
B. Control	..	..	..	2.53	..	..

Comments on Table 8.

(1) Lime has had no effect on the amount produced in the first crop of hay.

(2) Superphosphate, although applied to ground similarly treated in the previous season, has given a sufficient increase in the first crop to leave a profit of 12s. 6d. per acre.

(3) The lime-plus-super application has not been profitable. The increase shown must be attributed to the super, and is just sufficient in the one crop to pay for this treatment. Arrangements were made to follow up the effect of the treatment in the following season.

General Conclusions.

(1) It is evident from a perusal of the foregoing notes that the application of superphosphate as a top-dressing for pastures in the districts covered is not always profitable. In the main the better types of soil give the best response.

(2) Lime has given very varied results as measured by the effect in the season of application. Although those soils treated for lime-requirement were all lacking in this substance, the response to application seems to have very little relationship to the requirement indicated. However, on account of the length of time over which the effect of a dressing of 1 ton carbonate of lime per acre should extend, it would be unwise to draw definite conclusions. Further, the amount of data so far collected is extremely small, and with such diversity of result as that experienced in the Cheviot district alone it is evident that much work in a great number of places is required before generalization can be made.

(3) Where lime *has* proved beneficial the addition of superphosphate has further increased the return when applied in the same season as the lime.

(4) It must be borne in mind that the increases in weight of hay do not represent the full benefit derived from a treatment. The effect on the nutritive value of a pasture must be considerable. Further, where only one crop of hay is weighed in a season it seems reasonable to suppose that this crop, taken after the maximum growing-period of from twelve to sixteen weeks, represents not more than half the total growth for the year. Hence any increase resulting during the greater part of the year would be clear profit in addition to any already shown.

Thanks are due to the farmers mentioned for placing paddocks at our disposal and co-operating whole-heartedly in the work. Mr. F. E. Ward (now Director of Agriculture, Tasmania) was associated with the writer in the work, particularly that of the 1924-25 season, and his valuable collaboration is here acknowledged.

Subterranean-clover seed has been saved in the Marlborough district this season. Mr. F. W. Greenwood, Instructor in Agriculture, Blenheim, states that heretofore the difficulty has been not so much in harvesting as in shelling, so much soil being present with the harvested seeds and stems. It has now been found that autumn and spring harrowing combined with top-dressing enable the plant to assume a more erect habit, so that the seed-head in most cases is not buried in the earth, but seeds in the shade and protection of the foliage above it.

Among other causes of cotty wool is a sudden change in the weather from sultry heat to wintry conditions, such as sometimes occurs in spring. The more open the character of the wool the greater the effect of these climatic vagaries.

TESTING OF PUREBRED DAIRY COWS.

C.O.R. CLOSING LIST FOR-CALENDAR YEAR 1926.

Dairy Division.

THE appended list completes the publication of records for purebred dairy cows which gained certificates in 1926.

The outstanding performance appearing in the list is that of the Jersey senior two-year-old Prie-dieu, with 734·62 lb. of butterfat, tested by Mr. A. E. Watkin, of Takanini. Prie-dieu's sire is Peep's Gay Boy, and her dam Pride's Waitui. Her present record places her in the position of runner-up for the Jersey senior two-year-old class-leadership to the end of 1926.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.			
				Days.	Milk.	Fat.	
JERSEYS.							
Junior Two-year-old.		Yrs.	dys.	lb.	lb.	lb.	
Beechlands Ladylike	A. Moreland and Son, Te Rapa	2	10	241·5	305	5,597·1	455·49
Makanui Molly ..	H. G. Livingston, Kiwitea ..	2	4	240·9	330	5,625·1	344·33
Green Part Pet ..	H. E. Walters, Waitoa ..	1	335	240·5	291	5,995·7	331·52
Sorceress ..	Nicholas Bros., Mangatoki	1	358	240·5	305	5,027·4	302·73
Green Park Tiny ..	H. E. Walters, Waitoa ..	1	268	240·5	260	5,166·0	272·86
Senior Two-year-old.							
Prie-dieu ..	A. E. Watkin, Takanini ..	2	308	271·3	305	14,982·7	734·62
Marshlands Best ..	A. E. Watkin, Takanini ..	2	334	273·9	334	9,723·6	485·34
Jersey Brae Graceful	Martin and Murray, Temuka	2	305	271·0	305	8,754·9	452·90
Three-year-old.							
Thornlea Royal Rose*	G. E. Yelchich, Waiuku ..	3	89	285·9	305	12,392·0	581·38
Marshland's Fern's Eminent	Martin and Murray, Temuka	3	54	282·4	342	11,190·8	563·19
Adare Lady Clare ..	J. A. Kurth, New Plymouth	3	325	309·5	359	10,103·1	537·54
Penybryn Cream ..	Banks and Son, Kiwitea ..	3	359	312·0	304	8,733·7	484·95
Arthingworth Renata	E. Smallbone, Richmond	3	345	311·5	365	7,790·4	461·43
Wichenford Anemone	F. I. Washbourn, Timaru ..	3	361	313·1	365	6,283·0	320·62
Four-year-old.							
Springvale Fair Lady	G. E. Cowling, Manaia ..	4	335	347·0	321	8,798·3	433·12
Bilberry's Bright Eyes	C. P. Crowley, Kaponga ..	4	342	347·7	289	7,699·5	390·30
Mature.							
Collingwood's Angel	E. Hellyer, Dunedin ..	6	224	350·0	365	12,527·8	704·34
Mystery's Golden Girl	A. E. Watkin, Takanini ..	7	119	350·0	365	12,024·3	679·75
Fox's Freda ..	H. E. Walters, Waitoa ..	10	25	350·0	341	10,963·5	615·71
Lala's Devotion ..	John Hale, New Plymouth	8	287	350·0	305	9,982·0	513·44
Cowling's Maid ..	G. E. Cowling, Manaia ..	7	300	350·0	315	8,874·9	493·90
Miro's Lass ..	J. A. Kurth, New Plymouth	7	2	350·0	365	6,296·8	427·04
Glorified Princess ..	F. I. Washbourn, Timaru ..	7	14	350·0	305	6,231·0	405·69



ALFALFA SUPREMACY (A. A. WAGSTAFF, WAIHOU).

C.O.R., 1926, in Jersey junior two-year-old class : 10,292.3 lb. milk, 650.37 lb butterfat. Test commenced at age of 1 year 281 days.



NA RIWI MERCENA (H. W. REEVE, WAITOA).

C.O.R., 1926, in Friesian junior two-year-old class : 16,945.2 lb. milk, 685.5 lb. butterfat. Age at commencement of test, 2 years 84 days.

LIST OF RECORDS—continued.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
FRIESIANS.						
<i>Junior Two-year-old.</i>		Yrs. dys.	lb.		lb.	lb.
Totara K.P. Polkadot*	Piri Land Co., Auckland ..	2 143	254·8	365	12,709·4	487·13
Hobson Sunflower Segis	Hobson Farm, Ltd., Auckland	2 35	244·0	241	11,111·4	371·11
Tikorangi Nazli No. 1	Bevan Estate, Manakau ..	1 317	240·5	299	7,500·5	286·73
Tikorangi Manor Beets No. 1	Bevan Estate, Manakau ..	2 8	241·3	312	7,897·9	274·72
Tikorangi Woodcrest Rag Apple No. 1	Bevan Estate, Manakau ..	2 4	240·9	285	6,675·3	266·16
Hobson Pontiac Ormsby	Hobson Farm, Ltd., Auckland	1 350	240·5	190	6,640·7	262·18
Tikorangi Domino No. 1	Bevan Estate, Manakau ..	2 16	242·1	307	6,687·9	257·21
Tikorangi Diamond No. 1	Bevan Estate, Manakau ..	1 364	240·5	313	7,341·2	240·81
<i>Senior Three-year-old.</i>						
Rosevale Jewel Sylvia*	North and Sons, Omimi ..	3 323	309·3	365	17,376·6	584·61
Grahamholm Lady May Ormsby	Hobson Farm, Ltd., Auckland	3 234	300·4	208	10,081·7	340·31
<i>Junior Four-year-old.</i>						
Glen Iris Maori Maiden	O. A. Cadwallader, Greytown	4 7	314·2	365	19,626·7	687·67
Rosevale Princess Midget Posch*	North and Sons, Omimi ..	4 19	315·4	365	19,351·7	593·75
<i>Senior Four-year-old.</i>						
Rosevale Helena Posch*	North and Sons, Omimi ..	4 322	345·7	365	22,694·6	728·06
<i>Mature.</i>						
Peria Claudia 1st* ..	A. Thirlwall, Matamata ..	6 14	350·0	332	16,147·4	662·57
Rosevale Princess Lassie*	North and Sons, Omimi ..	6 85	350·0	365	16,556·2	632·73
Viola Beauty Burke*	J. J. Walker, Ohangai ..	9 126	350·0	328	19,615·9	582·35
Nepean Countess Alcartra Pietje*	J. J. Walker, Ohangai ..	5 324	350·0	351	15,520·6	519·29
Carlownie Aurora ..	R. K. Macdonald, Edendale	5 26	350·0	365	13,390·4	389·59

MILKING SHORTHORNS.

<i>Mature.</i>						
Peach Grove Lady Dinah 2nd	W. J. Slack, Otaki Railway	7-8	350·0	332	14,551·6	571·26

RED POLLS.

<i>Two-year-old.</i>						
Tutamai Retourne ..	B. W. Harvey, Waverley ..	2 322	272·7	320	6,900·5	301·36
<i>Four-year-old.</i>						
Susie Ann ..	B. W. Harvey, Waverley ..	4 65	320·0	354	11,109·3	448·48
<i>Mature.</i>						
June ..	B. W. Harvey, Waverley ..	5 354	350·0	282	8,985·8	372·82
Star 1st ..	B. W. Harvey, Waverley ..	7 30	350·0	327	10,205·0	363·33

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

*Second-class Certificates.***Jerseys.**

<i>Junior Two-year-old.</i>		Yrs. dys.	lb.		lb.	lb.
Vive La Clare ..	H. C. Sampson, Hillsborough	1 298	240·5	365	7,956·1	452·22
Makanui Silver Coin..	H. G. Livingston, Kiwitea	2 28	243·3	365	7,182·7	419·97
Wichenford Morning Light	F. I. Washbourn, Timaru ..	1 206	240·5	365	5,855·7	273·45

Mature.

Fern Grove Lady Beatrice	H. C. Sampson, Hillsborough	9	9,350·0	365	13,796·3	688·04
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SILO AT PUKEORA SANATORIUM FARM.

DURING the past season a good practical form of silo was constructed at the Health Department's Pukeora Sanatorium Farm, near Waipukurau, Hawke's Bay. The silo, a good idea of which is afforded by the photo, consists of ten stout posts, 10 ft. 6 in. long (standing 6 ft. 6 in. out of the ground), between which are built up 4 in. by 2 in. totara battens 5 ft. long, held loosely in a groove shaped on the posts. The structure, which has an inside diameter of 17 ft., is bound round at the top by a $\frac{1}{2}$ in. wire rope, 55 ft. long, fitted with tightening-means. The ensilage material is weighted with earth, as in the stack method. For access to the ensilage, when required for feeding out, one post and the battens at that point are removed, this giving an opening of 10 ft. A minimum of waste is ensured as compared with the stack system. The fodder ensiled this season was part of the production of a fine stand of lucerne, the material being brought to the silo by horse-sweeps and elevated as shown.



SEASONAL NOTES.

THE FARM.

PASTURE-MANAGEMENT.

YOUNG pasture should be very carefully treated during winter, and never fed closely. Wherever possible the first grazing should be with sheep, and a time chosen when the ground is not wet. Neglect of these simple precautions is responsible in many cases for the short life of newly sown grass.

Older pastures should be well harrowed with the tripods whenever opportunity offers during the next two or three months. The operation is best done after rain, when the stock-droppings are soft. In pasture-management harrowing is probably next in importance to top-dressing, and hence, incidentally, the importance of stumping old bush land as time permits during winter. The action of the tripods stimulates the roots of the plants, tears out moss, and breaks away the dead and decaying matter, allowing both sun and air to penetrate the surface soil, all of which is so necessary in developing a vigorous growth of useful pasture elements. The large proportion of inferior grasses, such as Yorkshire fog, often seen in old pastures is largely due to the fact that the droppings have not been spread. This results in the killing-out of the better grasses, and round the edge of the droppings fog soon appears and flourishes.

Top-dressing was dealt with last month, and the work then suggested should be pushed on while weather conditions are good. The same applies to liming. In applying lime it is not always necessary to make heavy dressings. Generally the most profitable procedure is to apply from 6 cwt. to 15 cwt. of carbonate of lime, or half this weight of burnt lime, and repeat again in a year or two. Of course, if the land is very sour it will be necessary to apply a heavy dressing at once to correct this condition.

It is advisable generally to commence manurial top-dressing while the pasture is still in good condition. If it is markedly deficient in clovers and contains much weed-growth it may be better to break up and establish anew. Such a course applies specially to arable land under Canterbury or similar conditions.

Yard manure saved round cow-sheds and stables during the season, and not required for other crops, should be carted out and spread over weak pasture.

SEED POTATOES.

Potato-growers should be busy now selecting seed from the main crop for next season's use. The crop should be looked over before being dug, and the seed tubers taken from selected plants. This seed should be carefully stored. If special seed-rows have not been kept, the grower should have rogued several rows. Failing this, he should prepare for next season's seed-rows by the following suggested method: Before the tops have fully died down go through several rows and pick out what are considered to be healthy and true-to-type plants. Mark these, and later dig them and select the seed. This seed should be carefully stored and used next season on three or four distinct seed-rows.

The amount of seed produced from these rows should be sufficient to plant a fairly large area in the following season with seed fairly true to type.

LUCERNE.

During the coming month lucerne stands should be limed if necessary and, if dry enough, grubbed. Land that is being prepared for lucerne should be thoroughly limed before the end of June. Where a seed crop is required next season the stand should at this period receive a top-dressing of superphosphate, or, on the colder and wetter soils, super and blood-and-bone or any manure providing both nitrogen and phosphate. The periodical liming of lucerne stands is an important factor in prolonging their life.

CROPS AND TILLAGE.

No opportunity should be lost during the next few weeks of turning over any land still required for spring sowing. For such crops as mangolds, carrots, and potatoes autumn or early winter ploughing is most important. In the case of lea land, as long as the weather is fair the plough can be kept going; it requires a considerable rainfall to make such land too wet. Where old pastures are to be broken up, skim-ploughing in the autumn or early winter, followed by disking, especially on the heavier soils, as a preparation for the deeper spring ploughing, is a good insurance against dry summer conditions, besides allowing frost and sunshine to break up the soil and make fresh plant-food available.

In the North, renovation of old sod-bound *paspalum* areas by ploughing in narrow furrows is best carried out in late autumn.

Wheat-growers in Canterbury and North Otago will be particularly occupied with sowing operations during May. Interested readers may be referred back to some special notes on wheat-growing which appeared in the *Journal* for April of last year, pages 270-71.

WINTER FODDERS AND STOCK.

The feeding of supplementary winter fodders should not be neglected even when the dairy herd is drying off. Where swedes are grown they may be relied upon, together with a reasonable ration of hay. Care should be taken not to feed too many swedes to breeding-ewes in the early stages of pregnancy. Where roots are grown on heavy clay land they should be pulled and fed out as far as possible on the poorer parts of adjoining pastures; thus, while improving the latter, the soil-texture of the field in crop is not spoiled by puddling. Should roots or other fodder crops be fed off, stock must have access to adjacent pasture, and be kept off the crop entirely during wet weather if they are to remain healthy and the crop is to be fed at maximum profit. Where swedes or turnips are being fed off on the ground the shells should be grubbed up with the cultivator, provided the weather is dry.

Mangolds should be sufficiently ripened during May in a normal season to be pulled and clamped. If this cannot be done, and it is intended to leave the crop in the ground, the roots should be pulled or harrowed out in sufficient quantity to keep at least three weeks in advance of feeding. Neglect to observe this precaution is still responsible for trouble, especially in dairy cows; it likewise causes purging in sheep. Where conditions are suitable and the necessary cultivation

is given, the mangold crop is one of the most profitable, but must not be carelessly fed. In localities where frosts are severe the roots are better pulled and clamped rather than left in the field.

Lambs should never be in low condition when turned on rape or other green fodders, otherwise loss may occur. It is always wise to keep them on good, clean, fresh pasture for a time, while gradually allowing their digestive organs to become used to the change of diet.

Great care should be taken to see that dry dairy cows are fed to their fullest during the resting-period. Many farmers are still under the impression that when a cow is dry she can do with less food. This is a great mistake; it is during this resting-period that the cow should be built up if she is to give a good return in the ensuing season. Further, it should be remembered that during this period the cow is carrying a big calf. Careful experiments have shown that the better a cow is fed for a month or two before calving the better her returns will be when she comes in. There is no need to fear that a cow will be too fat at calving-time.

FEEDING OUT ENSILAGE.

Ensilage made by the stack method can be fed to stock as soon as the temperature is even in the stack and the latter has settled. This should be in about two months. A well-made stack, however, will continue to improve for a considerable period. When opening up the stack commence at one end by dividing it into three sections and taking out a corresponding cut—say, from 5 ft. to 6 ft. square. Throw the weighting-material from the first section back into the trench from whence it was taken (if earth is the weighting-material used). The ensilage may then be cut with a sharp spade or hay-knife. It should be well shaken up when being forked on to the dray, so that stock may get a fair sample and be encouraged to take it readily.

The hillside silo is filled from the upper and emptied from the lower side, the let-in sliding-boards forming the door on the front side being taken out as the surface of the ensilage falls with removal of the material.

In the case of permanent tower silos the ensilage must be taken from the top, not the bottom. For feeding to the stock a sufficient layer should be taken off evenly morning and evening. If the ensilage is of chaffed material it may be fed in boxes or troughs; if not, it can be distributed over the paddock similarly to stack ensilage.

A cubic foot of chaffed ensilage should weigh about 40 lb., which would be sufficient for a day's ration for the average cow (20 lb. morning and evening) in addition to what grazing she may obtain in the fields. A ton of ensilage will feed forty-four head of large cattle, or about four hundred and fifty sheep, for one day. Ensilage should not be overfed to stock, as it has a loosening tendency. For correcting this, if necessary, $\frac{1}{4}$ lb. precipitated chalk added to every 100 lb. of ensilage has been found effective. Only as much ensilage as is required each day should be fed out. It decomposes easily on exposure to the air, and then becomes dangerous as a food.

As with roots, it is good practice to feed out on the poorest paddocks, in order to build up fertility. The ensilage should be spread over the ground so as to get good results evenly, besides obviating the ill effects of poaching.

GENERAL REPAIRS.

Late autumn is a good period for effecting general repairs on the farm, such as to fences, gates, cow-sheds, and creek-crossings. On dairy farms these crossings should receive early attention. If this is done before the really wet weather sets in a great deal of extra work and worry will be avoided in the spring.

—*Fields Division.*

THE ORCHARD.

HARVESTING AND STORAGE OF FRUIT.

PICKING, packing, and marketing will still be engaging the attention of the apple and pear growers. Every care should be exercised in the handling of the fruit, so as to avoid the damage and deterioration which is caused through rough handling and lack of judgment in the picking. At this time of the year the fruit is frequently wet with rain or dews, and as far as is practicable it should not be gathered until perfectly dry. This point is more important in respect to fruit which it is intended to store for a time. Only sound mature fruit should be placed in storage. Growers who have mid-season varieties stored in their sheds should examine the fruit at frequent intervals, and if it shows any indications of going off no time should be lost in placing it on the market. Fruit which should be marketed at once is frequently held until it has gone off considerably before being sent away. As a result of its condition, in conjunction with the handling, the fruit often arrives at the market in a wasty and almost unsaleable condition.

Such late maturing varieties as Statesman, Rome Beauty, Newtown Pippin, Sturmer, &c., which are firm-fleshed, will with proper treatment keep longer than mid-season varieties. In consideration of this, in the main, varieties of this class should be given preference in the matter of cold storage. A cool, even temperature should be maintained, moderately dry, but not sufficiently dry to cause the fruit to shrivel. In situations where the average daily temperature is not low at this time of year, and where there is considerable fluctuation between the day and night temperatures, fruit intended for long storage should be placed in a cool store. It is advisable to repack stored fruit before placing it on the market.

DRAINAGE.

The drainage of heavy retentive soils should not be neglected. Tile drains, though more expensive, give the best results, and are the more convenient and permanent type of drain for the orchard. Existing open drains should be cleaned out and put in order, and the outlets to pipe drains cleared so as to let the drainage water pass freely away.

PREPARATION FOR PLANTING.

Where planting is intended this season the land, if not already cultivated, should now be thoroughly worked up and made ready. Good, deep working is required, and no effort should be spared to put the soil in good order before the trees are planted. After the trees are planted the land cannot be worked to the same advantage as now. Opinions differ in respect to the most favourable time to plant out trees. Some growers prefer the autumn, while others favour spring

planting. In general, autumn planting is suitable for dry, warm soils when properly matured trees are available, whereas in cold soils it is not advisable to plant the trees until spring.

SHELTER.

In exposed situations it is important that windbreaks should be planted to protect the trees from cold and heavy winds from the time they are set out. It frequently happens that no provision is made for providing shelter for the young trees, and as a result in subsequent years many trees and their fruits suffer badly. While shelter is important, it should not be overdone; it should be open enough to let the air through, but at the same time effectively break the wind. Shelter-trees should be planted a reasonable distance from the fruit-trees which it is intended they should shelter.

ORCHARD SANITATION.

Sanitation as applied to the orchard includes such practices as cultivation, pruning, control of pests and diseases, drainage, &c. The period between the completion of fruit harvest and the commencement of the winter work should be devoted to a thorough clean-up of the orchard and its surroundings. All fruit-cases should, where necessary, be repaired and stored away in a dry place for next season's use. The props used in supporting the fruit-laden branches should be gathered up and placed in a convenient place. Live fences should be trimmed, and where necessary the trees in the shelter-belts topped to keep them within bounds. Remnants of crops, prunings, diseased and decaying fruit, and all rubbish should be destroyed. Cleanliness in the orchard is essential.

PLOUGHING.

The orchard should be ploughed as early as possible after the fruit crop is gathered, so that the work may be completed before the land becomes too wet. In circumstances, however, where a green crop has been sown and has not reached a sufficient height it would be as well to delay the ploughing for a while in order to obtain the benefit of any additional growth the crop may make during the late autumn and early winter. The soil is greatly benefited by being exposed to the winter frosts and rains. To facilitate the surface drainage the land should be ploughed with the fall and not across the slopes. Plough to the trees, leaving an open furrow along the middle of the lands between the rows.

—W. K. Dallas, Orchard Instructor, Dunedin.

Citrus-culture.

The maintenance of a citrus-grove in good order and continued profit is a much more difficult proposition than the establishment of young citrus-trees. Planting is usually done in the spring, and the climatic conditions from then on up to late autumn are generally ideal for the growth of the citrus-plant—warmth, equable conditions, with periodic rain. But for permanent maintenance trees have to be fostered, and in some localities even coaxed, through periods of the year when climatic and other conditions are far from natural to citrus-growth. With the advent of such unfavourable periods it is well to consider

some of the main detrimental conditions with a view of ensuring against undue damage from them.

Surplus moisture : This is annually responsible for more serious setbacks to trees, or even total loss, than possibly any other cause. All the citrus tribe delight in warm soil-conditions, as evidenced by their habit of surface rooting. Allowing the land to remain waterlogged to saturation-point can only result in unfunctioning, if not decaying, roots, and if the tree is not lost it receives such a check as to take more than normal time to recover in the spring. Citrus-culture is most successful in parts of the world where water contents of the soil are regulated by irrigation. While we cannot regulate the amount of rainfall, there are several cultural points which, strictly observed, will minimize undue water content of the soil. Drainage is, of course, most necessary, and should be attended to even before the trees are planted, but it is quite possible that consolidation of the land has to some extent nullified the effect of what was once thought to be ample under-drainage. It is therefore well to ascertain whether sufficient drains have been made, and whether they are properly clean and in good working-order. If not, this should be corrected ; otherwise the success of the whole system is menaced. Surface water can be quite as damaging as a waterlogged subsoil. Early winter regulation of the land-surface should therefore be so done as to avoid hollows, and the land between the trees left with a double open furrow to take away surplus surface water.

Shelter : The very nature of citrus-trees predisposes them to damage from exposure, broken branches or limbs, partial defoliation, a general hardening of the bark, and a loss of vitality. The main provision to minimize this is adequate shelter on the windward side. Where no shelter exists this should be remedied during early winter, so that shelter-trees or hedge-plants may be well established and ready to grow in early spring. Much existing shelter thought to be sufficient proves on examination to be deficient in so far as the ragged lower parts and gaps are concerned. This may be remedied by the erection of brush-wood breakwinds if the position is unfavourable for the growth of interplanted hedge or shelter plants.

Frost : Much annual damage by frost is perfectly obvious, but the reduction of vigour and retardment of development are also considerable though not so noticeable. Most damage is done to young growth and at a variable minimum distance from ground-level, so that in areas subject to light frosts the trees grow beyond apparent damage in a few years ; but in these first years all possible protection should be given. Adult trees also often suffer, mainly by injury to young growth, particularly that made during the previous autumn. Proper spacing of branches and laterals, and the avoidance of highly nitrogenous manures during late summer, will permit the wood to mature to a greater degree of frost-resistance.

Cleaning up : Owing to collar-rot and the amount of decayed bark caused through fresh manures or decaying litter being piled up round the boles of the trees, it is wise at this season to thoroughly clean up round the trunks. A mulch of general litter or manure may be very desirable during summer, but is more often injurious during winter.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

THE PROSPECTIVE BREEDING-BIRDS.

Now that the work of culling unprofitable stock has been carried out, the best hens selected and carefully marked for future breeding purposes, and the pullets settled down in their winter quarters, the poultry-keeper may look forward to an easier time during the next few weeks. There are, however, several matters which require attention if the plant is to be maintained at a high standard of efficiency.

In the first place, particular attention should be directed to the feeding of the prospective breeding-hens. They should be well fed but not overfed; on no account should the birds be allowed to become in an overfat condition during the moulting-period, or just before being called upon to lay eggs for hatching purposes. This is important, for it is well known that eggs containing strong germs, and chickens which are easy to rear, cannot be produced from an overfat hen. From now on the birds should be frequently handled, and if there is a tendency for them to put on surplus fat the ration should be slightly reduced; they should also be encouraged to exercise as much as possible, so as to prevent the storing-up of body-fat.

Another important matter that should be attended to now is the final selection of cockerels for next season's breeding-pens. In this important work it must be always remembered that constitution is the first requirement if a male is to prove a high-class sire. A specimen may exhibit good type, size, breed points, &c., and have an outstanding pedigree of performance behind it, but if there is the slightest evidence of a weak constitution the bird should be rejected. While constitutional vigour should be given first consideration, the question of breed type, standard weight requirements, and a knowledge of the bird's ancestors from an egg-producing standpoint must be also taken into consideration. After the birds have been carefully selected, male birds carrying large combs and long wattles, which are frequently seen in the lighter breeds such as Leghorns and Minorcas, should have these removed. As a result of this slight operation a bird will usually feed better and produce a greater number of fertile eggs and strong chicks. The operation can be simply performed with a pair of sharp scissors. In order to prevent bleeding a good dressing of fuller's earth should be applied to the cut part.

Where possible the breeding-birds should be provided with a good range—that great essential for building up bodily vigour.

SURPLUS COCKERELS.

The importance of marketing at once all surplus cockerels that are about five months old cannot be emphasized too strongly. It is never a wise policy to keep a cockerel beyond that age, for if not marketed then it will be weeks and even months before the bird can be brought to prime condition, and then, although heavier than at the prime-chicken stage, the return will not be as profitable. Once the chicken stage has passed, the consumption of food is increased, this being caused by the greater growth of plumage, bone, &c., necessary for the development of an adult bird. Obviously this process must be completed

before the matured adult stage can be attained. This will be readily understood when it is considered what a drain there must be on the bird's system in producing the thousands of adult feathers that nature demands.

This, however, is not the only drawback, for even if a fully developed cockerel is marketed in absolutely prime condition it does not appeal to the poulterer, to whom it is known as a "stag." The fact of it having a well-grown spur, sharp at the point, reduces its value as a table bird. Generally such a bird is coarse and larger than is generally desired for the high-class trade—in fact, it is usually classed on a par with an old hen, or, in other words, as a boiling-fowl. It is the flesh of the prime five-month-old bird that is most sought for the high-class trade and commands the highest value. Most poulterers are prepared to buy cockerels by the pound if they are offered at a young age and in prime condition. Thus the aim of the poultry-keeper should be to produce a maximum weight in a minimum period of time. This means that the birds must be well fed and managed from the time they are hatched to the day they are marketed. It costs much less to produce a pound of flesh than a pound of frame. In short, it will pay the farmer to prime his poultry just as it pays to prime other classes of live-stock.

CROP-BINDING.

This condition may occur from different causes, but it is usually due to the birds eating long fibrous grass, &c., the material rolling together and becoming a tangled mass which will not leave the crop. Lawn clippings are often responsible for crop-binding. It is true that when these are short and cut in a succulent stage they make an ideal green food for fowls. Where the danger lies is in feeding the clippings when they are long and in a fibrous condition. In this way the bird has no option but to swallow them whole, and often with ill effects. Crop-binding is rarely seen where the birds are provided with a free range, as then they are not only able to select the most succulent pieces of grass, but in addition are enabled to pick it off to a length that will not be injurious.

Another common cause of crop-binding is when grass hay is used as litter for the birds to scratch in, especially where the floor of the house is damp, or where the hay becomes damp or wet from any cause. This has the effect of bringing the hay back to a more or less natural state, with the result that the birds are induced to eat it. Where ample green food is provided the birds will be less inclined to eat the hay. Grass hay cannot be looked upon as a good scratching-material unless it is frequently renewed and maintained in a dry state. As with most poultry troubles, the best way of dealing with crop-binding is to prevent it. Long grass and similar substances should not be supplied to fowls of any age without being finely chaffed. By way of further precaution the birds should have an ample supply of sharp gravel grit before them at all times.

For curing crop-binding—when the bird is worth the trouble—the crop may be opened with a sharp knife. The outer skin should be first cut and drawn downwards, and an incision made into the crop itself large enough for inserting the finger and drawing the fibrous substance away. The crop should then be stitched separately with silk, and the outer skin afterwards. Feed on soft food for a few days, and withhold

water for at least a day. Unless the bird is a valuable one it is not worth going to this trouble, as the ailment is likely to recur.

SOFT OR DISTENDED CROP.

In this condition the food and water remain in the crop and fail to enter the digestive tract. The cause of the trouble is usually a clog in the tract. For treatment kneel down and hold the bird between the knees. Open the mouth with the left hand, stretch the neck upwards, and pour water heated to blood temperature slowly down the throat until the crop is filled. Then gently knead the crop until the mass is softened. Then turn the bird head downwards, and at the same time knead the crop with the fingers, which will assist the bird to vomit. If the operation is not successful it may be repeated. The bird should be given a dose of Epsom salts (about the tenth part of a packet dissolved in water) and allowed to fast for at least a day. Also make sure that the patient, as well as the whole of the flock, is supplied with plenty of sharp grit.

—F. C. Brown, *Chief Poultry Instructor.*

THE APIARY.

MARKETING THE CROP.

AT the close of the season the beekeeper should give his undivided attention to marketing his crop. It usually happens that a good season causes something akin to a panic among a large proportion of the producers, and as a result they are too anxious to dispose of their crop, at anything but remunerative prices. The increased cost of working-equipment, packages, &c., has become a serious burden on the profits of the apiary, and at the present moment there is every indication that the cost of packages to the producer will be increased. Apart from the cost of equipment, very few beekeepers take into consideration the amount of labour and time requisite to produce a crop; and, if beekeeping is to be made to pay, these factors must not be lost sight of. Where bees are run as a side-line very rarely do we find the item of labour charged against the crop, and as a result it is sold at a low figure.

There are far too many jobbers in the honey trade. Their operations act against the legitimate producer and tend to unbalance the market. Too often the beekeeper is led away by their talk of overproduction and lack of demand for his commodity, and he is anxious to dispose of his crop before his fellow-producers can dispose of theirs. A brighter, better, and more businesslike way of dealing would be for beekeepers in every case to meet together and agree upon prices. By organized effort the price of honey can be reasonably raised and its value as an article of food placed before consumers. It is pleasing to note that the principle of co-operation is being steadily extended among honey-producers, and that the operations of the Honey Producers' Association, which was formed for the purpose of jointly handling the product of the individual, is leading to larger sales, with more uniform and better prices. The building-up of a payable local market depends largely on

the disposal of the surplus crop, and this can only be accomplished by an organized scheme of export. The efforts of the industry to arrange such a scheme have already been the means of increasing the local market value of honey.

With respect to the local market, until such time as the producers are combined for the purpose of establishing bottling-depots in every centre the beekeeper must not relax his efforts in preparing his crop for market, more especially if increased consumption and higher values are the objective. In the absence of co-operative bottling depots too many beekeepers make the mistake of forwarding their honey in bulk lots, to be afterwards retailed under a name which is not that of the producer, and usually not even that of his agent. It is far better for the beekeeper to attend to his own bottling than to allow his honey to be disposed of haphazard by any one into whose hands it may fall. While honey is in a liquid form it is little trouble to fill 1 lb. or 2 lb. packages, stamped with the producer's own name and trade-mark, and in a year or two he will find that his product will need no advertisement. Quality and care tell in the long-run. Looking at our markets to-day, we find the crop is moved off as quickly as possible, and no general effort is made to supply honey at all seasons of the year.

The value of attractive packages should weigh with the producer, whether the honey is put up in bulk for the merchant or in small packages direct for the retail trade. In order to appeal to the consumer the packages containing honey must be made as attractive as possible, and every care observed in its preparation as an article of food. An inspection of lines sent forward to market will serve to demonstrate the advantage of careful preparation. Consignments forwarded in good, clean cases, carefully graded, and contained in new tins readily command attention; whereas lines which have been packed in rusty tins and present a rather unattractive appearance generally are hard to dispose of. Too often merchants are compelled to sell them at a reduced rate, although the quality of the honey is quite on a par with that packed in new packages. In such cases the producer is apt to blame the merchant for a reduction in price, but as a rule the fault lies with himself.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

REFITTING AFTER THE BUSY SEASON.

If there is such a thing as an interval in the horticultural calendar it is now, although the term has only a relative meaning in such a climate as we enjoy, which generally permits the operations of sowing and reaping the whole year through. The present is a suitable time to refit, and make such repairs to gates, roads, sheds, &c., as may be required. Shelter plantations and hedges also may receive attention. Too often these valuable improvements, upon which so much depends, are roughly trimmed with an axe—and at out-of-season periods at that. The result is not only great disfigurement, but dead stumps and branches in the trees and on the ground are the most suitable means for breeding diseases and pests of many kinds, and is sure in a very short time to defeat the purpose for which the trees were planted.

Where it is necessary to cut into old timber of any size it should be removed by a clean saw-cut close up to the main limb from which it originates, previously making a slight undercut a few inches along the branch to be severed, so that when it falls away the bark is not ripped from the main limb from which it has been removed. In this way wounds heal as quickly as possible, without any decay setting in to endanger the life of the tree. Such trimmings need to be dealt with promptly by removing them into an open space, cording the heavier portions for firewood, and burning up the smaller twigs and branches on the spot if there is no other use for them. In this way only may the plantations be kept effective for a long period, and the danger from disease and fire be reduced to a minimum.

Young hedges of most kinds require to be cut hard back for two or three seasons to make them thicken and stool at the base. It is very desirable that this should be done, and the work may be undertaken now. Not only does a properly grown hedge look better, but a strong base is one of its most important requirements.

Metalling gateways and cleaning up open drains and water-tables is seasonable routine work which if done now keeps the land drained during the colder wet weather, and brings it into early condition for planting in the spring-time.

STERILIZING THE SOIL.

In these days when repeated pure cultures are grown by fruitgrowers and market-gardeners it is not surprising that the land becomes "sick," as far as these special crops are concerned. Glasshouses devoted to tomato-culture year after year, often with no alternating green cover-crop between the seasons, are a typical case in point. The trouble is often intensified by the fact that many of the diseases affecting the land and plants are seed-borne.

As before pointed out, rotation cropping is the best and cheapest method of dealing with these troubles, but in many instances it pays to go to the expense of sterilizing the land to bring it into condition. For doing this successfully there is doubtless much more to be learnt than is known at present, but the experience of every season is of value. Steam is still regarded as the most effective means of sterilizing the soil, and for glasshouse work of any extent it is doubtless the best. The first cost may be considerable, but with care the outfit will last for many years. There is also a possibility of using the plant for heating purposes in the glasshouse in the ordinary way, which, with the ordinary materials for the hotbed becoming scarcer every season, would be a great convenience. For soils infected with fungus troubles the formalin treatment has given good results, while for soils in which eelworm or other insect pests are located treatment with carbon bisulphide has been beneficial when administered when the land was bare.

CLEANING UP THE GLASSHOUSE.

Where glasshouses have not been cleaned up yet this season they should receive careful consideration now. The good, clean crops usually grown in new houses are largely due not merely to the new land but also to the clean condition of the house. Where there is any area of concrete or brick work a coating of hot limewash should be applied; in

this it is usual to include a little bluestone solution, or flowers of sulphur, or kerosene. A little cement also mixed in will thicken the mixture and give good adhesion.

EARLY SPRING PEAS.

In the warmer localities a crop of peas sown now may be harvested in early spring, and is often a very profitable crop. A good strain of the Stratagem variety is generally used for this purpose. It is generally advisable to give plenty of room between the rows for this crop, and they should run in a north-and-south direction. If the seeds are soaked for twenty minutes in kerosene it will protect them from vermin; and as soon as the plants are through the ground a suitable dust or spray will further protect them from attack. A spray of bordeaux mixture will protect them from slugs, and probably from birds also.

IN THE TOBACCO-BARN.

Cured tobacco-leaf will now require careful attention, particularly where it is stored in buildings that are open to the atmosphere. Low temperatures and humid conditions quickly set up moulds that render the leaf valueless. Small charcoal fires about the floor of the shed are sometimes lit to counteract such conditions. In any case the sooner the leaf is stripped from the stalks now the better. For this purpose humid conditions are necessary for making the leaf pliable, so that it may be handled without breaking. This may be done by admitting a humid atmosphere at night, or it may be necessary to damp down the floor to create the necessary conditions. The best method, and one used in large establishments, is to have a chamber into which steam is admitted when the tobacco is in position; the conditioning then is rapid, and less likely to be accompanied by the development of fungus troubles. As the leaves are taken from the stalk they are graded for colour and condition. They are then bound together by the stems with a leaf, about twelve to a bundle, or, as it is usually termed, a "hand." The hands may be placed back on the curing-sticks for further drying, if necessary, or they may be bulked for a mild fermentation, or baled for market. For the latter purpose about 12 to 15 per cent. of moisture is required.

—W. C. Hyde, *Horticulturist*.

Noxious-weeds Orders.—The Dannevirke County Council has declared fox-glove to be a noxious weed within the district under its jurisdiction. Similarly, toad flax (*Linaria vulgaris*) has been declared by the Mount Hutt Road Board and gorse by the Greymouth Borough Council as regards their respective territories. The Waitaki County Council has declared Californian thistle *not* to be a noxious weed within that county.

Drinking-holes for Stock.—Losses of stock sometimes occur through unformed drinking-holes in open drains. Cattle after drinking are apt to wander up the drain and become bogged, and are often lost. This wandering up the drains is principally due to fouling of the water at the drinking-hole by the stock treading up the mud. In making a drinking-hole in an open drain the slope dug should be cut deep at the drain end, so as to form a narrow bay. A large log should be placed at the bottom of the slope, and the drinking-place fenced from the drain by a strong rail fence. It is also a good plan to line the bottom of the drinking-hole with stones.

THE NEW DAIRY-PRODUCE REGULATIONS. MANUFACTURE AND EXPORT.

(Concluded from March.)

Condemned Dairy-produce.

80. In every case where dairy-produce is condemned by an Inspector—(a) The Inspector shall as soon as practicable notify the owner of the produce that it has been condemned; and (b) the Inspector shall, at the expense in all things of the owner, cause such produce to be removed to some convenient place and there so treated as to become absolutely unfit for human consumption. (c) The owner shall as far as required by the Inspector assist him in carrying out the provisions of this clause, and for that purpose shall do whatever the Inspector directs. (d) The net proceeds realized for such produce shall be payable to the owners.

Weighing, Sampling, Testing, and Recording at Manufacturing Dairies.

81. (1.) Clauses 82 to 101 hereof, both inclusive, shall apply only to dairy factories whose owners purchase milk or cream, to be paid for wholly or partially according to the percentage of butterfat contained therein, for the manufacture of butter or cheese, and only to milk or cream so purchased.

(2.) In the same clauses the word "owner" means exclusively any owner (as defined in the said Act) of a dairy-factory who purchases milk or cream as aforesaid.

82. Every owner upon weighing any cream delivered to his dairy factory shall, where the weight is an exact number of half-pounds, record the weight accordingly, and where the weight is not an exact number of half-pounds record it at or above the nearest half-pound below the exact weight; and if any such cream is weighed in a container shall, where the weight of the container is an exact number of half-pounds, compute the tare accordingly, and where the weight of the container is not an exact number of half-pounds compute the tare at or below the nearest half-pound above the exact weight of the container.

83. Every owner shall secure, for the purpose of testing, a truly representative sample of each delivery of milk or cream made to the dairy factory. The quantity of each sample shall be sufficient to enable a test to be made as hereinafter provided and to leave a portion sufficient for retesting.

84. The owner shall—(a) Take such sample separately from each can or weighing, and compute the weight of butterfat in the can or weighing from the test made by him of the sample and the weight of the milk or cream in the can or weighing; or (b) make a composite sample of each supplier's milk or cream for each day or other suitable period by taking samples from each can or weighing in proportion to the total weight of milk or cream represented by each sample, and compute the weight of butterfat from the test made by him of such composite sample and the weight of milk or cream in all the cans or weighings represented by the composite sample.

85. The owner shall keep each such separate or composite sample in a cool place, and in a tightly stoppered glass bottle plainly labelled with the supplier's name or number.

86. The owner shall not add, or suffer to be added, to any such sample any extraneous matter save necessary preservative in a powder or tablet form.

87. Every such sample shall be tested on the customary testing-days (which, excepting during the months of June, July, and August, shall be at intervals not exceeding twelve days) by the owner or by an agent appointed in writing by him for that purpose, and in either case the tester shall be a person competent in the work of testing by the prescribed method in use at the dairy factory.

88. As soon as practicable after the testing is completed the tester shall make with ink or indelible pencil an accurate record showing the name or number of each supplier whose milk or cream was tested, and opposite thereto the percentage, by weight, of butterfat as ascertained by testing the sample. He shall also date and sign the record, and file it at the dairy factory or at the owner's office. The owner shall retain all such records for at least eighteen months after the close of the dairy factory's financial year, and shall keep them open to examination at reasonable hours by any Inspector, or by any supplier but only with respect to any milk or cream sold by such supplier.

89. (1.) In the case of separate samples as provided for in subparagraph (a) of clause 84 the owner shall keep unchanged, until three o'clock in the afternoon of the day on which the tests were made, or, in the case of tests made after three o'clock in the afternoon, until noon of the following day (as the case may be), in tightly stoppered glass bottles, each plainly labelled with the supplier's name or number, the portion of the original sample not abstracted in testing.

(2.) On any day the owner shall, should an Inspector so direct, retain half, by number, of the samples of the previous day's testing, but not necessarily more than fifty, until three o'clock in the afternoon. The Inspector may specify individually the samples to be so retained, and, if the Inspector does so specify, the owner shall retain the samples specified by the Inspector.

90. In the case of composite samples made as provided for in subparagraph (b) of clause 84 the owner shall in like manner, and irrespective of an Inspector's direction, keep the portion of each sample not abstracted in testing for four clear days following the day on which such samples were tested: provided that samples need not be retained beyond the end of the part-monthly testing-period following that in which they were taken.

91. (1.) The owner or tester shall not use any pipette in testing milk, or any Babcock or Gerber test-bottle for milk or cream, unless such pipette or bottle is of an approved pattern and has been tested and marked by an authorized officer of the Department of Agriculture.

(2.) Such authorized officer shall destroy any pipette or bottle which, on being tested by him, is found to be, in his opinion, insufficiently accurate for use in testing milk or cream, and no compensation shall be payable by the Department of Agriculture in respect of such destruction.

(3.) Any person who submits any dairy glassware to an authorized officer for testing shall on demand pay to the Department of Agriculture fees as follows: Milk or cream bottles, 2d. each; skim-milk bottles, 1s. each; pipettes, 3d. each; and thermometers, 1s. each: plus postage in every case.

92. The owner or tester shall not use any appliance for weighing samples of cream for testing unless such appliance is of a type approved by an Inspector and in good working-order. Every weighing-appliance used in testing shall be sensitive to 0.05 grams (metric).

93. In testing samples of cream the amount put into the test-bottle shall be 9 grams or 18 grams in the case of the Babcock test, and 5 grams in the case of the Gerber test, and the correctness of the amount shall be ascertained by actual weighing.

94. (1.) In testing milk the percentage of butterfat as read from the Babcock test-bottle shall include the whole of the fat from the bottom of the column to the highest point of the meniscus.

(2.) Fat-saturated alcohol, or oil of a lower specific gravity than that of butterfat, shall in testing cream by the Babcock method be used for levelling the meniscus of the butterfat column in the test-bottle, and the reading shall be taken from the bottom of the column of fat to the point of junction between the fat and the levelling-fluid.

95. The owner, or an agent or agents appointed in writing by him for that purpose, shall on each day on which butter is made in the dairy factory make an accurate record in ink or indelible pencil of the weight of butter made on that day, showing separately the weight packed in bulk and in pats, also of the weight of such butters delivered by the dairy factory on that day. The owner or such agent shall sign and date each day's record, and file it at the dairy factory or the owner's office, and the owner shall keep it there for at least eighteen months after the close of the financial year to which it relates.

96. The owner shall make, and file at the dairy factory or his office for at least eighteen months after the close of the financial year to which it relates, an accurate record daily, as near as may be, of the following particulars: (a) The weight in pounds, and the butterfat percentage by weight, of all milk or cream received from each supplier; (b) the weight in pounds of butter credited to each supplier for each test, and for each month or other period of payment; (c) the number of pounds of butterfat purchased in any form from persons other than suppliers and used in the manufacture of butter or cheese, or sold as milk or cream or otherwise disposed of; (d) the weight of butter purchased or received from other dairy factories or otherwise; and (e) the weight of all butter disposed of, whether manufactured or purchased.

97. The owner shall, at or prior to the time of each payment made or account rendered in respect of milk or cream to any of his suppliers, furnish such supplier with a statement of the weight and test of his milk or cream, and the number of pounds of butterfat computed therefrom, for each testing-period covered by the payment or account; or, when payment is based on the weight and test of each can or single delivery, with a detailed statement of the weights, tests, and pounds of butterfat of the several lots being paid or accounted for.

98. Any person who falsifies any record of a kind referred to in clauses 82 to 97 inclusive of these regulations; over-reads or under-reads any milk or cream weighing, or any Babcock, Gerber, or other test; fails to comply with the requirements hereinbefore prescribed in conducting any test; or in any other way makes any incorrect determination of butterfat, commits a breach of these regulations.

Check upon Sampling, Weighing, Testing, and Recording.

99. An Inspector may at any reasonable time do any of the following things, at or in connection with any dairy factory: (a.) Take without payment such quantities as may reasonably be required as samples of any lot of milk or cream or milk-products whosoever found, and may weigh and test such samples. (b.) Examine and test any samples of milk or cream kept in accordance with clauses 89 and 90 hereof for retesting. (c.) Examine the records of receipts of milk, cream, butterfat, butter, or cheese; of all Babcock, Gerber, or other tests made; of the weight of all butter or cheese or other dairy products manufactured daily; and of the weight of butterfat for which any supplier has been credited or paid.

100. The Inspector shall relock or reseal any container which has been unlocked or unsealed by him for the purposes of the last preceding clause.

Investigation of Owner's Annual Statement to Suppliers.

101. (1.) Every application to the Minister under section 5 of the Dairy Industry Amendment Act, 1922, for an investigation into the correctness of an owner's certified annual statement to his suppliers shall be made in the form No. 25 in the Schedule hereto.

(2.) The approved security to be lodged under the provisions of the last-mentioned section may be given by way of bond for such amount as the Minister may in each case determine.

Exhibiting Acts and Regulations.

102. Every owner of a manufacturing dairy shall place and keep in each such dairy, in a conspicuous place accessible to any supplier of the dairy, a copy of the Dairy Industry Amendment Act, 1922, and of these regulations.

Duties and Penalties.

103. Where a duty is directly or by implication imposed by these regulations and it is not specified in the said regulations by whom it shall be performed, the owner concerned shall at all times be responsible for its due observance or performance.

104. Any owner of a dairy factory, or any purchaser, seller, or collector of milk, cream, or dairy-factory products, or any carrier or storage-owner dealing with milk, cream, or such products, who refuses admission to, or hinders, any Inspector in the exercise of his duty, or who refuses or neglects to render such reasonable assistance as may be required by an Inspector in that respect, commits a breach of these regulations.

105. Any person who (a) fails to observe or perform any duty directly or by implication placed upon him by these regulations, (b) does anything contrary to the provisions thereof; (c) not being an officer in the exercise of his duty alters or obliterates, or causes to be altered or obliterated, any owner's brand, any grade-mark, or any record or document made or used in pursuance of these regulations; (d) counterfeits any such brand, grade-mark, record, or document; (e) empties, or partially empties, or otherwise interferes with, the contents of any package or thing marked in pursuance of these regulations in order to put therein or substitute therefor any other contents; or (f) improperly uses any previously marked package or thing for the purpose of representing or implying that the marks thereon are valid, commits a breach of these regulations.

106. Any person who commits any breach of these regulations in respect of which no penalty is provided elsewhere is liable to a penalty of £50.

107. Nothing contained in these regulations shall impose any liability upon the owner of a supplying dairy who is not the occupier thereof, where the supplying dairy is in the occupation of any other person by virtue of a tenancy created prior to the coming into operation of these regulations; but this exemption shall not affect the contractual rights and liabilities to each other of the owner and occupier of any such supplying dairy.

WEATHER RECORDS : MARCH, 1927.

Dominion Meteorological Office.

GENERAL SUMMARY.

MARCH is regarded as the first month of autumn in these latitudes, but the earlier half was decidedly summerlike—calm, warm, and fair generally; the latter part of the month was, however, quite different in character—cold, unsettled, and boisterous. The contrast between the two periods was very marked; an observer in Otago found the average temperature of the first half ten degrees higher than that of the latter.

The trough of one westerly "low" passed on the 16th, and was soon succeeded by a more violent and extensive disturbance of a similar type. The lowest reading of the barometer, 28.95 in., was recorded at 3 p.m. on the 20th, at the Bluff; and this storm was apparently affiliated to a cyclonic disturbance the centre of which passed over the South Island, the lowest atmospheric pressure (28.65 in.) being observed at Christchurch at 7 p.m. on the 23rd. These storms will be remembered by being associated with the close of the Royal visit.

Although popularly described and recognized as "equinoctial"—and not without some justification, for there have been in past years several notable storms about the time of the Equinox, the greatest one, in 1918, causing the Raetihi bush-fire—there is no apparent scientific reason for associating these disturbances with the solar crossing of the Equator, and their concurrence must still be regarded as fortuitous.

The 28th witnessed the passage of the trough of another westerly or antarctic "low," after which the barometer rose steadily with strong southerly winds, bringing a cold snap at the close of the month. There were some slight frosts, and snow was left rather low down on the southern mountains.

With the exception of the east coasts of both Islands, rainfall was generally much above the average—it was, indeed, excessive on the higher levels and southernmost parts of the South Island. The total fall for the month at Arthur's Pass was 36.42 in., of which 10.35 in. fell on the 23rd, and of this 8.52 in. was registered in nine hours. Floods were reported in the Waumakariri and other rivers on this account, and there was also a big flood in Marlborough at this time.

The westerly gales were troublesome to orchardists, for apples, in particular, had not quite matured. The heat and dryness of the summer, however, left a warm soil on which the rains produced a profuse and wonderful growth of autumn pasturage.

RAINFALL FOR MARCH, 1927, AT REPRESENTATIVE STATIONS.

Station.				Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
<i>North Island.</i>							
Kaitiaia	..	..	..	Inches. 4.18	9	Inches. 1.22	Inches. 3.58
Russell	..	..	..	3.43	8	1.21	3.35
Whangarei	..	..	..	2.87	13	0.88	4.81
Auckland	..	..	..	4.57	15	0.62	3.03
Hamilton	..	..	..	7.54	17	1.84	3.88

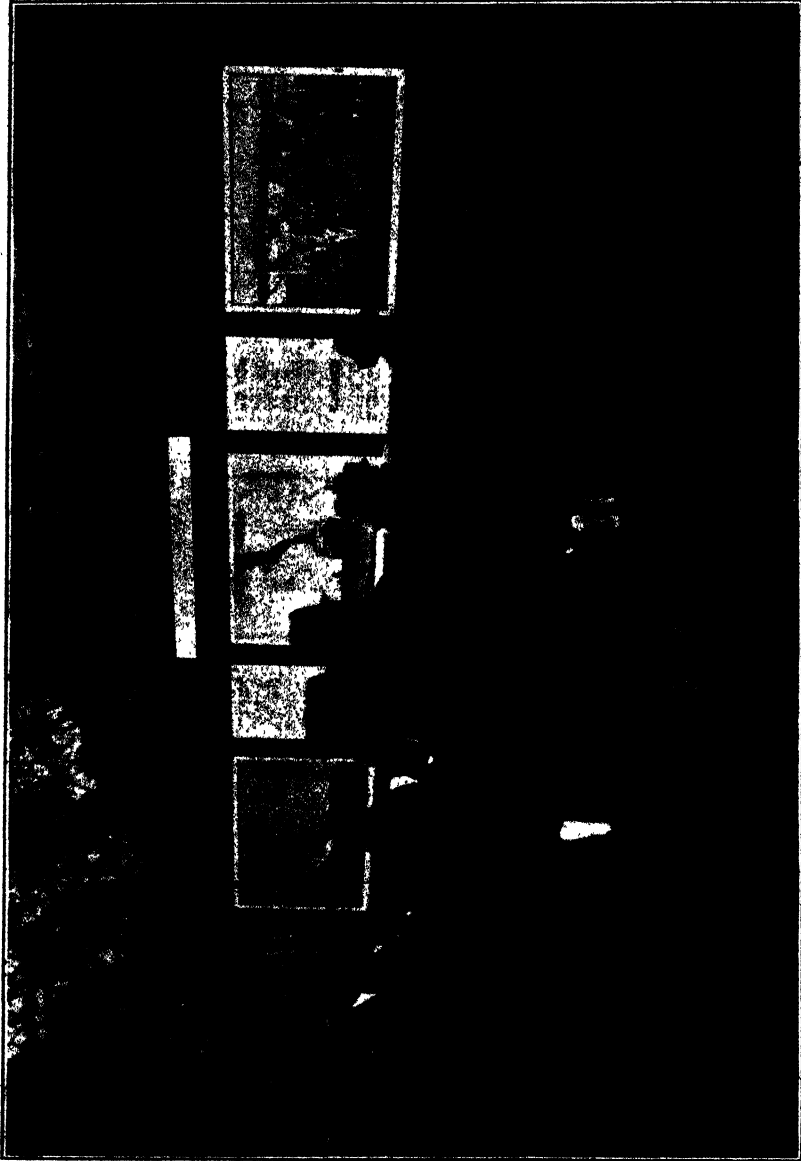
RAINFALL FOR MARCH, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
<i>North Island—continued.</i>				
	Inches		Inches.	Inches.
Kawhia	6·84	15	1·74	3·12
New Plymouth	6·40	17	1·22	3·62
Riversdale, Inglewood	12·71	16	2·08	7·39
Whangamomona	9·53	19	2·34	5·46
Tairua	5·80	11	1·70	6·73
Tauranga	5·10	11	2·06	4·10
Maraekaho Station, Opotiki	7·26	12	1·64	4·00
Gisborne	2·59	11	0·66	4·51
Taupo	4·22	9	0·98	3·53
Napier	1·08	7	0·50	3·29
Maraekakaho Station, Hastings	1·85	10	1·03	3·10
Taihape	3·31	14	0·87	2·95
Masterton	2·72	9	1·51	3·15
Patea	5·31	16	1·72	3·60
Wanganui	3·63	8	1·33	2·62
Foxton	3·38	7	2·00	2·20
Wellington	3·39	12	1·15	3·29
<i>South Island.</i>				
Westport	7·04	18	1·32	5·80
Greymouth	12·30	20	2·16	9·12
Hokitika	15·56	20	4·20	9·70
Ross	19·05	16	2·60	10·35
Arthur's Pass	30·42	17	10·35	9·74
Okuru, Westland	20·52	20	4·13	15·48
Collingwood	8·04	15	1·91	4·19
Nelson	2·21	10	1·10	3·08
Spring Creek, Blenheim	1·05	8	0·61	1·81
Tophouse	8·00	18	2·43	4·33
Hammer Springs	5·24	16	2·13	2·92
Highfield, Waiau	2·52	8	0·76	3·00
Gore Bay	1·80	7	0·56	2·20
Christchurch	1·15	11	0·39	2·05
Timaru	1·52	15	0·74	2·31
Lambrook Station, Fairlie	2·94	11	1·62	2·58
Benmore Station, Clearburn	4·54	14	1·70	2·94
Oamaru	1·50	9	0·39	1·73
Queenstown	0·75	13	1·59	2·63
Clyde	3·70	11	1·50	1·50
Dunedin	5·06	17	2·18	2·98
Wendon	5·34	19	1·13	2·93
Gore	4·97	19	1·07	3·47
Invercargill	8·05	21	1·31	3·00
Puysegur Point	11·82	19	2·04	8·00

— D. C. Pates, Director.

SEED-TESTING CHARGES.

THE charges made by the Seed testing Station of the Department of Agriculture on commercial samples have been reduced to 1s per sample for either germination or purity test, and 2s. for combined germination and purity test. These are half the amounts previously charged. The revised scale came into force from 1st April—the beginning of the new financial year.



EMPIRE MARKETING BOARD POSTERS DISPLAYED IN WHITEHALL, LONDON.

VETERINARY SURGEONS BOARD.

APPOINTMENTS have been made to the Veterinary Surgeons Board constituted under the Veterinary Surgeons Act, 1926, as follows: Registrar, C. J. Reakes, D.V.Sc., M.R.C.V.S., Director-General, Department of Agriculture, Wellington, who is also chairman; A. M. Brodie, M.R.C.V.S., Hastings; H. S. S. Kyle, M.P., G.M.V.C., Christchurch; W. C. Barry, M.R.C.V.S., District Superintendent, Department of Agriculture, Wellington.

Dr. Reakes was appointed by the Governor-General from among the veterinary surgeons in the employment of the Department of Agriculture, Mr. Brodie on the recommendation of the Minister of Agriculture, and Messrs Kyle and Barry on the recommendation of the New Zealand Veterinary Association (Inc.).

Members (with the exception of the Registrar) will hold office for three years, with the right of reappointment.

Regulations under the Act, governing registration, were published in the *Gazette* of 17th March, 1927. The full text of the Act was printed in the *Journal* for November last.

EMPIRE MARKETING BOARD POSTERS IN BRITAIN.

THE photograph reproduced on the opposite page, taken recently in Whitehall, London, shows some effective posters set up by the Empire Marketing Board. The poster on the right is a New Zealand dairying scene (showing delivery of milk to a Taranaki cheese-factory). "Ships in the Channel" is the subject of the centre poster, and on the left is a Canadian harvest scene. Mr F. C. Herrick painted the New Zealand and Canadian pictures, and Mr Norman Wilson, R.L., the centre piece. This set of posters is being displayed all over London and in the largest cities of Britain, in specially favourable positions.

The text of the letterpress displayed to the left of the New Zealand poster reads as follows:--

THE DAIRIES OF NEW ZEALAND.

WHENCE CAME THE HERDS? Just over a hundred years ago the first cattle were shipped to New Zealand. The great dairy herds of New Zealand have been bred from stock bought from the farmers of Britain. To-day in New Zealand, every night and every morning, a million cows are milked. *The herds went from Home.*

WHENCE CAME THE MEN? The men and women that built up the great dairy industry of New Zealand were Englishmen and Scotsmen, Welshmen, and Irishmen. They are proud of their race. *The men went from Home.*

Every year you eat £17,000,000 worth of New Zealand butter and cheese. Every year New Zealand buys from you £24,000,000 worth of the goods you make. So each country helps the other.

EMPIRE BUYERS ARE EMPIRE BUILDERS.

WHEAT AND OATS THRESHING RETURNS.

RETURNS of actual threshings received by the Government Statistician up to 19th March from threshing-mill owners showed that until then totals of 1,140,394 bushels of wheat and 683,433 bushels of oats had been threshed out. The average yield per acre in cases where particulars of areas were furnished (covering 99 per cent. of total threshings) worked out at 38.08 bushels for wheat and 43.26 bushels for oats. The figures for the Canterbury, Otago, and Southland Land Districts respectively were as follows. Canterbury—Wheat, 1,026,107 bushels threshed, averaging 38.60 bushels; oats, 535,170 bushels threshed, averaging 43.52 bushels. Otago—Wheat, 69,934 bushels, averaging 36.42 bushels, oats, 100,337 bushels, averaging 47.35 bushels. Southland—Wheat, none returned to date stated; oats, 2,856 bushels, averaging 75.16 bushels per acre.

REVIEW.

"PLANTS OF NEW ZEALAND," by LAING and BLACKWELL; 408 pp., with 175 illustrations; third edition; 15s., Whitcombe and Tombs, Ltd.

It has come to be recognized more and more clearly of late years by those whose work is in any way dependent on the teachings of a science that of none of its branches can it be said, "This is no concern of mine, this can have no bearing on practical everyday affairs." This country still contains among its areas of immediate or potential agricultural value a great many that have on them enough of the original plant covering to serve as the most reliable of teachers—to offer advice that cannot be ignored by the man whose ambition is to make the very most of his land holdings.

The first step in making use of this advice is to know at least something of the language in which it is written—in other words, to have some idea of the names that have been given to plants by botanists. The use of such names as *Paspalum dilatatum* and *Poa pratensis* by all farmers who have anything to do with these grasses shows that there is no fundamental prejudice in this direction, and that it may be wiser to use names of general application all the world over, instead of mere local terms that quite likely are applied to totally different plants in another part of the country. It may be said that whoever is interested enough can quite easily name any plants he wants to; but while it is true that all the flowering-plants and ferns known at the time of its publication are fully and accurately described in Cheeseman's "Manual of the New Zealand Flora," this is a technical work requiring special training in the meaning of botanical terms, and it is not illustrated except for two supplementary volumes showing drawings of comparatively few of the plants.

The present work does not claim completeness—many plants that are of little importance are not described at all, but the illustrations, which consist of photographs, sometimes of parts such as the flowers and fruit, and sometimes of the whole plant as it appears when growing, are both numerous and clear, and to the layman are often more vividly descriptive than the best technical account could be. After all, the ability to know one plant from another is only one of many steps on the way to an understanding of that branch of botany which must have the greatest appeal of any to the enthusiastic farmer, which tells him what it is about one plant that makes it fail when all conditions seem favourable to its development, while another—with apparently similar equipment—is able to hold its own, and do very much more than hold its own, in the country it is occupying.

New Zealand may well be proud of her contributions to the literature of ecological botany, which is the science of the living plant in relation to its surroundings. Each of Dr. L. Cockayne's two books—"The Vegetation of New Zealand" and "New Zealand Plants and Their Story"—is a classic in its way. The author of the work under review (we learn from the preface that Mr Laing is alone responsible for the preparation of the third edition), though he has made many original contributions to botany, would be the last to claim for "Plants of New Zealand" the name of a work of research in ecology. As he himself says in the introduction, "The attitude of botanists towards many problems has altered much since the original edition of the work, and it has been our endeavour to reflect that attitude in the pages of this book." Herein lies its strength, for it consists essentially in a summing-up of all that so far is known of the flora and the vegetation of New Zealand in ways that make it clear to the non-technical reader. In this most difficult task there is shown a remarkably level judgment—one that is by no means ready to accept a theory as fact merely on account of its novelty or ingenuity, but which at the same time is quick to see a discovery that is destined to leave its mark in the development of the science. A book of this type may well find a place on the farm book shelf.

E. H. A.

Peas for pigs should not be threshed but fed in the pod. The exercise in getting the peas out of the pods is good for the pigs, but, more important still, they cannot gorge themselves. Peas fed in this manner are properly chewed and masticated, whereas if threshed and fed whole a great many of the peas pass through the animal.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

PARALYSIS IN PIGS.

G. B. B., Tolaga Bay :—

I am having a lot of trouble with my pigs, almost at any size or age from four weeks to five months. Quite a number go in the hind quarters and flop about, if they are not killed they pine away and die in about three weeks. They are fed on skim-milk, with maize occasionally. They have plenty of room to roam about, fresh water to drink, and rough grass to eat. I have tried shutting them up in sties with no better result. If you could advise a remedy I would be greatly obliged.

The Live-stock Division :—

The condition "paralysis" is a common one in young pigs throughout the Dominion, and in practically all cases can be attributed to the dieting on skim-milk. Cold and damp, also the presence of intestinal parasites, are regarded as contributing causes. A diet of which skim-milk is the sole or principal constituent is insufficient for a growing animal lacking the ingredients necessary for body-building, therefore it should be supplemented with an allowance of pollard, linseed-meal, crushed oats, or grains, &c.

STORAGE OF APPLES ON THE FARM.

C. B. CLAPHAM, Feilding :—

Please advise me of the best way of storing apples (Sturmers) for winter use on the farm.

The Horticulture Division :—

To store Sturmer apples for winter use on a farm you are recommended to pick the fruit with the stem intact, and handle them with more than the usual care. Grade out the fruit that is perfectly sound, place it in boxes (benzene-cases are very suitable), and stack them in a cool, well-ventilated shed. Some 3 in. by 2 in. timber should be placed beneath the stacks to keep them off the ground, and 1 in. strips between each tier of boxes. Also an inch or so of space should be left, vertically, between the cases. In this way the fruit should keep with little or no loss, till the middle or end of August. The damaged fruit that is graded out should be used up at once, and no attempt made to keep it for any time.

BORER IN LEMON-TREES.

F. REYNOLDS, Thornton, Bay of Plenty :—

I am concerned about the borer in my lemon-trees, ten years old. The affected trees have perhaps a teacupful of workings of the borer on the ground at the base of the trunk, and look as if they will die soon. Could you suggest a remedy?

The Horticulture Division :—

To keep lemon-trees free from borers they should be properly pruned, all weak and dead wood being also carefully removed. Spray and feed the trees well to keep them in good health, and they should be very little troubled with this pest, which chiefly attacks trees or parts that are in weak condition. The larvæ infecting limbs may be destroyed by injecting benzine into the holes and plugging them afterwards.

LAMPAS IN HORSE.

"FARMER," Onga Onga :—

We have a horse six years old which is very bad with lampas. Could you inform me of a cure?

The Live-stock Division :—

Lampas is a natural condition occurring in horses during the development of the permanent incisor teeth, as, owing to these being short at first, the palate and gums become slightly inflamed and appear swollen. The condition passes off as the teeth grow longer, and no treatment is necessary beyond providing soft and chaffed food for the short time the mouth is sore.

SURFACE ROOTS OF SHELTER-TREES.

F. R. L., Eketahuna :—

Is it necessary to dig ditches along shelter-belts so as to force the roots of the trees deeper into the soil? I have planted two shelter-belts of pines, and do not want the roots of the trees coming too far out into the paddock near the surface, because of ploughing later on.

The Horticulture Division :—

If the land is of fair quality, with a good subsoil, and the enclosing fences are about as far from the trees as the main limbs extend, there should be little trouble from surface roots. In the case of a light soil on shingle, the surface roots are generally extensive but necessary, and should be allowed to remain if a high shelter is required. Much depends on selecting the right kind of trees for the soil and purpose.

HARD-MILKING COW.

R. MORRISON, Dunedin :—

I have a cow which after calving is easy to milk in the first few weeks, and then gradually gets harder. Do you know of a remedy or preventive for this?

The Live-stock Division :—

The causes of difficult milking are many and varied, and it would be extremely difficult to diagnose the trouble in the cow referred to without examination. Generally speaking, a cow which is difficult to milk is not worth keeping unless she is a pedigree animal. If the one in question is not of this class it might be advisable to fatten her off for the butcher.

FORTHCOMING WINTER SHOWS.

Whangarei A. and P. Society : Whangarei, 10th to 14th May.

Poverty Bay Winter Show Association : Gisborne, 11th to 14th May.

Waikato Winter Show Association : Hamilton, 31st May to 4th June.

Manawatu A. and P. Association : Palmerston North, 14th to 18th June.

South Taranaki Winter Show Company : Hawera, 29th June to 6th July.

Wellington Winter Show Association : Wellington, 15th to 30th July.

Secretaries are invited to supply dates of their shows for publication in this list.

New Zealand Wool Committee.—The Minister of Agriculture has appointed as members of this body Messrs. H. T. Milnes and L. B. Andreae.

The New Zealand Journal of Agriculture.

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No. 5.

IRON-STARVATION IN RUMINANT STOCK.

CORRELATION WITH LAND FEATURES IN THE PUMICE SOIL-PROVINCE.*

R. E. R. GRIMMETT, M.Sc., Analyst, Chemistry Section, Wellington.

It has been exhaustively demonstrated by B. C. Aston in this *Journal*† that the proximate cause of so-called "bush sickness" in ruminant stock is a shortage of iron in the animal, conditioned by an inadequate supply of iron in the pasture upon which the trouble develops. When, however, an attempt is made to trace the cause of this insufficiency of iron in the pasture to some single factor of the plant environment it is usually found that the evidence is so conflicting as to make any hypothesis untenable. It would thus appear that there are several sources of the trouble, all of which are necessary to its existence, at least in any marked degree.

Analysis has shown that the soils upon which iron-starvation develops are all well leached, and do not contain any appreciable quantity of solids, such as lime carbonate or manganese dioxide, likely to be antagonistic towards the availability of iron to the plant (See, however, reference to excessive oxygen later in this article.) It is probable, then, that the low degree of absorption of iron by the plant is due to a real lack of available iron in the soil, arising from an abnormal combination of factors which will not allow conditions to exist favouring the full assimilation by the plant of iron which is naturally in the soil.

The factors at present indicated as being involved are: (1) An altitude for the surface soil sufficiently above the permanent soil water table to prevent the rise of ground water from the latter by capillary attraction, to the surface; (2) a soil of texture coarser than a sandy loam—i.e., not containing more than about 5 per cent. of clay (nor alternatively sufficient humus to compensate); (3) a subsoil and substrata fairly pervious to water; (4) a fairly heavy annual rainfall; (5) an approximately horizontal, undissected type of topography; (6) an absence of seepage areas (this really follows as a corollary).

* In soil-survey classification the term "soil province" denotes an area of country having the same general physiographic features and in which the soils have been produced by a common force or group of forces.

† See in particular Vol. xxviii, Nos. 4, 5, 6, and Vol. xxix, Nos. 1, 2, 1924.

From a large number of observations and analyses it appears that at least the first five factors must be present before iron-starvation can develop, at least with any intensity. Each factor will now be considered separately.

(1) The altitude of the surface above the permanent ground water level must be sufficiently great to prevent any return, by capillary action, of soluble iron salts leached out of the surface soil during dry weather. This can usually be detected by observing the condition of the soil and pasture during periods of drought. This aspect of the trouble has already been noticed by Aston in the *Journal* for January, 1925, page 2, when discussing the difficulty of reconciling the fact that soils of identical mechanical composition may respond differently as regards their influence on the occurrence of iron starvation. Referring to an area at Kaharoa, in Rotorua County, he states: "Where there are no springs the trouble appears, but where there is plenty of spring or creek water the stock are said to be perfectly healthy. Thus at the extremity and lower portion of these two blind roads the cattle-sickness is unknown. The writer considers this as being a parallel to the well-known case of the lake-side paddocks (see this *Journal*, p. 370, December, 1924) and the bush-sick areas up on the hills. Where the soil is kept well saturated with water by seepage from springs or by the rise of subsurface water there is no sickness, and where the soil is dependent on rainfall the soil-water so soon drains away that there is not sufficient to act as a carrier of mineral plant-food from the soil to the plant-roots."

(2) It appears that when more than 5 per cent. of clay (or alternatively sufficient humus to compensate) is present in the soil, the latter becomes sufficiently impervious to so diminish the ratio of soakage to run-off of rainwater as to greatly retard leaching and the associated oxidation from dissolved oxygen. Under such conditions soluble or available iron salts can be developed and retained in the soil (probably mostly in the ferrous form). The best example of this is on the Patetere Plateau, near Mamaku. Aston, in this *Journal* for November, 1924, p. 334, states: "A feature shown by the Mamaku soils is the constant mechanical composition over a very large area. The analysis suggests that within a radius of two miles and a half from the Mamaku Railway-station there is no change except in isolated patches similar to that represented by soil-sample No. S 60. This country all bears, or has borne, a virgin forest of tawa and rimu. Travelling north, as one gets near the Oturoa Road, about five miles from Mamaku, an improvement is noticeable in the texture of the soil, which is much heavier, the coarse pumice being buried under finer material than that which occurs near Mamaku. A little to the north of the Oturoa-Rotorua Road the beech ('birch' of the settler) forest of the Mangorewa-Kaharoa Block is encountered, and here the soil is so perceptibly finer as to necessitate a new name, being now a 'sandy loam' instead of a 'sandy silt.' The former weighs 10 per cent. more than an equal volume of the latter."

(3) A semi-impervious substratum near the surface (such as an alluvial silt or a pan) will check the downward flow of water, encouraging an increase in run off and the development of springs and swamps, conditions favouring the availability of iron.

(4) It is evident that with a porous soil the heavier the rainfall the greater will be the leaching. In this connection it is interesting to note that iron-starvation usually appears to be most prevalent during very wet seasons.

(5) If the topography be one of sharp ridges and valleys, or of steep slopes generally, it is evident that leaching will be modified in two distinct directions: (a) The ratio of soakage to run-off will be lowered, less water sinking into the soil or else sinking through in more restricted areas; (b) water that does soak through and leach the higher levels will frequently seep out again, bearing its load of soluble material to the roots of the pasture plants at lower levels. It is on wide flat-topped hills, terraces, or plateaus, where soakage disposes of most of the rainfall and seepage areas or permanent swampy conditions are absent, that the trouble develops in its most acute form.

(6) Where the nature of the topography and subsurface strata allow of the development of seepage areas, or of springs and streams bordered by swampy pasture, even in relatively small areas, it appears to be quite general that stock having access to such do not develop the trouble; or, if so, to an extent diminishing with increase in the relative proportion of seepage or wet to leached soil pastures. If springs are localized or streams sharply entrenched so as to leave no room for wet, seepage, or unaerated soil pasture, they are usually found to affect the incidence of the sickness but little.

In a case, therefore, where iron-starvation manifests itself in an acute form the following conditions will typically be present: The location will be fairly high above the level of permanent water, the topography of a flattish or hummocky type, the soil of a type coarser than a sandy loam (sandy silt, coarse sand, fine gravelly sand, &c.) deficient in clay and humus, probably well leached, oxidized and low in iron content, the substrata of a pervious nature, and the rainfall fairly high.

Under such conditions there is a continuous downward movement of rainwater through the soil, carrying with it soluble material, including iron, which the colloidal material--clay and humus--is insufficient in amount to retain. At the same time much oxygen is supplied to the soil dissolved in the rain-water, tending to keep iron compounds in the more highly oxidized ferric form, which, except in extremely acid conditions, is insoluble and not available to the plant. An excellent instance of the leaching of iron and manganese from the pumice soil under favourable circumstances is given in this *Journal* for December, 1924, p. 372 (with a photograph), as follows: "At the railway quarry near the Rotorua Railway-station, at some quite recent date geologically, marshy conditions must have prevailed, the result being that a large amount of the iron and manganese was leached out of the first few feet of pumice and redeposited where the subsoil became much coarser. The dark nature of the underlying stratum is caused by the coating of the pumice gravel with oxides of iron (brown) and manganese (black) which have been leached out of the top soil." (Aston.)

In a normal soil the colloidal clay acts as a buffer surrounding particles of decaying vegetable matter (or humus) and protecting them from oxidation by the air or oxygen in rain-water. Under such conditions the particles exert a reducing action on the iron oxides or hydrates of

the soil, converting them into the more soluble ferrous form. In many cases this action is too intense, ferrous compounds in an excess poisonous to many plants being produced. This condition is to be seen in many swampy areas where the subsoil is found to be a blue or green colour, due to the ferrous iron, contrasting with the yellows or reds of normal soils, in which most of the iron is in the ferric state. Only a small fraction of the total iron is required to be in this reduced or ferrous condition for the pasture (and the animal) to receive its normal ration, but in "bush-sick" soils even this amount is apparently not found. Direct oxidation of reducing material in the soil is able to proceed, very little reduction of the ferric compounds occurring, and what does occur being rapidly leached out.

Some examples of how the various factors operate together to produce the different degrees of iron-starvation actually observed may be given. On portions of the Kapakapa Road, and at Te Pu and Ngawaro (Rotorua County), perhaps the most acute degree of the sickness is manifest. All the factors enumerated are present (see this *Journal* for January, 1925, p. 2). The situation is relatively high above permanent water, the soil is a fine gravelly sand or a coarse sand, the substrata are pervious, consisting of sands and tuffs, the topography that of a plateau or gently valleyed and hummocky, and the rainfall heavy, resulting in a leached soil and an absence of springs and seepage areas.

At Mamaku the chief factor modified is the texture of the soil, which is sandy silt rather finer and less pervious than the soils mentioned above. Sickness is less acute but still severe.

At Oturoa the soil is finer, being a sandy loam, and the altitude less. Springs and creeks occur. Sickness is absent or of a light degree.

Farms at the ends of Kapakapa and Kaharoa Roads, and in parts of Ngawaro and on the northern side of Rotoiti Lake, are either free or exhibit only a mild form of the trouble. The soils and other factors are practically the same here as in other parts of the Kaharoa and Ngawaro districts, with the exception of topography, which is usually found to be well dissected, with springs, swamps, seepage areas, and streams.

At Hamurana, and generally on the low-lying land bordering the lakes, not only is no sickness found, but sick animals from other areas recover quite rapidly. The soils vary from sandy silts to fine gravelly sands, and the only modified factor appears to be the altitude above permanent water, which is often but a few feet or even inches, and in winter some land may be submerged. Springs, seepage areas, and swamps occur from under the hills and higher terraces to the lake edge.

The higher terrace lands, which are intermediate in altitude and position between the low-lying healthy lakeside soils (as at Rotorua) and the high sick soils (as at Mamaku) are also found to be intermediate as regards the incidence of sickness.

At Te Ngae, Okareka, and other places where sufficient thickness of the 1886 Rotomahana eruption mud remains to form a new surface soil no sickness either in cattle or sheep occurs, even on the high flattish land with a coarse pumice subsoil. Apparently, the fact that the soil is a sandy loam with over 5 per cent. of clay is largely respon-

sible for this immunity. In addition, little time has elapsed for leaching to occur; iron is present in considerable quantity, and, judging by the colour (bluish grey), is not yet greatly oxidized.

The road from Rotorua to Atiamuri passes through a large area of country the surface soil of which, generally of coarse texture, is derived from subaerially deposited pumice, as in the remainder of the district. This deposit varies in depth from 1 ft. to 4 ft., the substrata consisting of alluvial deposits varying from coarse water-worn gravel to well-sorted sands, silts, and clays of a compacted and fairly impervious nature. Excessive leaching of the topsoil seems thereby to have been prevented, and the run-off of rain-water and the formation of springs, streams, swamps, and seepage areas greatly increased. Thus, despite the presence of other factors favouring iron-starvation, the latter does not appear to have been found where farming on this area has been carried out.

Remedial Treatment for Iron-starvation.

Remedial treatment may be sought in three different directions:

(1) By supplying iron to the animal direct; (2) by supplying iron to the pasture direct, either through the leaves or through the roots; (3) by sufficiently modifying any of the factors contributing to the present unavailability of the iron in the soil.

(1) Feeding of iron salts to the animal, particularly iron ammonium citrate as originally introduced by Mr. Aston, is meeting with very general success, but obviously has limitations. Its greatest usefulness is found in the case of dairy cows, where the supplying of a regular ration is a fairly simple operation.

(2) The supplying of iron to the pasture is being experimented with, ferrous sulphate being used both as a soil top-dressing and as a weak spray applied to the green growth. So long as the conditions which contribute to the unavailability of the natural iron in the soil remain unaltered, it seems unlikely that the application of soluble iron salts to the soil will be of more than temporary benefit, the application needing to be renewed at fairly frequent intervals.

(3) Modification of contributory factors: (a) The altitude of the surface soil above the permanent water table can scarcely be modified by human agency.

(b) Texture of the soil: Of the two possible ways in which this could be amended—namely, by increasing either the clay or the humus—the latter is alone likely to be practicable. As recommended by Aston (this *Journal* for August, 1924, p. 90) green manuring, of all avenues open to the farmer, appears to be the most immediately promising for diminishing the trouble. By this means a closer and less pervious structure is given to the soil, the store of material capable of reducing the insoluble ferric to the more soluble ferrous form of iron salts is added to, and the general fertility of the soil increased. Somewhat the same end is attained by the establishment of a close and well-compacted turf of approved pasture-plants; and it is probably for this reason that with ageing of the pasture iron-starvation generally diminishes, while reploughing and resowing is said frequently to produce a temporary return to a more

acute stage. Rolling, trampling by stock, or other means of consolidation also should be beneficial, both by decreasing the air space in the soil and by tending to restrict soakage and leaching.

(c) Neither the nature of the substrata, nor (d) the amount of rainfall, nor (e) the general nature of the topography are factors amenable to practical control.

(f) Building up of the store of iron in the soil should be aimed at, even though much of it may be rendered for the time-being practically unavailable. Especially is the use of basic slag (or, better still, of a slag-super mixture) or a mixture of iron sulphate with superphosphate likely to be beneficial, as the phosphate encourages root growth, and, by bringing the roots into close association with the iron, may tend towards a greater degree of absorption. Mr. Aston has recently recommended the trial of "ferrous superphosphate," a mixture of superphosphate, sulphate of iron (hydrated ferrous sulphate), and hydrated sulphate of lime (gypsum). This mixture contains 12 per cent. of iron sulphate (see Griffiths's "Treatise on Manures," 1892, p. 283, Whittaker's, London).

(g) The utilization of any areas of seepage, swamp, or river flat existing on "bush-sick" farms should be zealously aimed at, pasture grown under such conditions being usually rich in iron and an antidote to the sickness.

The writer desires to acknowledge the great assistance he has received from Professor C. A. Cotton, of Victoria University College, Wellington, the leading New Zealand authority on land forms, who accompanied him on a tour through the Rotorua and adjoining counties.

YARROW FOR SECONDARY BURNS ON HILL COUNTRY.

REFERRING to Mr. E. Bruce Levy's remarks in the *March Journal* (page 161) on the inclusion of yarrow in seed mixtures for secondary burns, Mr. L. M. Monckton, of Waipukurau, writes to the Editor as follows.—

"Some thirty years ago a property I knew very well was entirely swept by a very heavy second fire, which practically killed all the grass. Yarrow came up very thickly after the fire (2 oz. per acre of it having been sown with the mixture when the bush was fallen and burnt some years before). After the secondary fire the property was resown, but it was late and the grass-seed came badly. The place was heavily stocked (two breeding-ewes per acre), and they lived all the winter on practically yarrow. What is more, nearly all the lambs went to the works off their mothers. Needless to say, the country was good, being all limestone, and of course it had the advantage of the heavy dressing of ashes from the second fire."

Production of Butterfat.—For the first nine months of the present dairying season—August, 1926, to April, 1927, inclusive—the quantities of dairy-produce graded for export by the Dairy Division totalled 66,456 tons of butter and 70,517 tons of cheese. In terms of butterfat this represents a net increase of 9.11 per cent. in butterfat production as compared with the corresponding period for 1925–26, and an increase of 1.9 per cent. over the same months of the 1924–25 season, which latter now holds the record for a year's production. Given favourable weather conditions for the remainder of the present season, there is thus a good prospect of a new record being established this year.

PASTURE TOP-DRESSING EXPERIMENTS IN WELLINGTON AND SOUTHERN HAWKE'S BAY, SEASON 1926-27.

W. J. McCULLOCH, Instructor in Agriculture, and J. G. GIBBS, B.Agr., Assistant Instructor in Agriculture, Palmerston North.

DURING the autumn of 1926 the Department of Agriculture, in co-operation with certain farmers in the Wellington and southern Hawke's Bay districts, laid down a series of some twenty manurial top-dressing experiments, with the object of making comparisons between the most commonly used phosphatic fertilizers.

The experiments were so designed that superphosphate, basic superphosphate, basic slag, and Ephos phosphate were applied in adjacent strips, each 6 chains long by one width of the top-dressing machine. To ensure a reliable comparison of the manures, or, in other words, to ascertain the effect on many parts of the same field, the series of manurial strips was replicated six times. Each manure was applied at the rate of 3 cwt. per acre, accuracy being attained by tying a sheet beneath the machine and weighing the quantity sown in a measured distance. Every fifth plot was left untreated as a control, enabling many comparisons to be made between the effects of the various manures and the natural untreated condition of the paddock. Further, while each fertilizer was repeated six times, the scheme was so designed that each manure in turn adjoined one of the controls or untreated areas.

In addition to this arrangement, three strips of ground limestone, each 1 chain wide and applied at the rate of 1 ton per acre, were sown across the experiment at right angles to the manures, alternating with similar areas on which no lime was applied. By this arrangement the effect of each manure, with and without the addition of lime, was obtained; likewise, where these strips of lime cross the untreated areas or controls the effect of lime against no lime was indicated.

OBSERVATION PLOTS.

It was hoped by laying down a number of such experiments, scattered throughout the districts, that even under ordinary grazing conditions differences between the various treatments would be apparent to the eye, in which case field-days would be held to enable surrounding farmers to discuss the relative effects of the manures. In experiments of this nature, where stocking returns are not obtainable and green weights cannot be conveniently secured, the differences can be measured only by observation, and must be very distinct to justify definite statements.

In comparing the treatments the chief points noticed were the development of clovers and good grasses, the proportion of bare ground, and the general condition of the pasture. Under "condition" is included the relative quantity of seed-heads (an indication of grazing), the quantity of dead, trampled vegetation, and the general colour of the pasture, which should be typical of vigorous healthy young growth. Where field-days were held farmers were unanimous in their opinion of which treatment had produced the greatest improvement.

A very interesting development occurred on the plots sown on Mr. J. Gildea's farm at Maharahara. The pasture was three years old, and was rather lightly stocked with dairy cows. The remainder of the paddock, not occupied by the experiment, was top-dressed with slag about the same date as the experimental plots. During the spring there was a good growth over the whole field, but a remarkable feature stood out distinctly. This was a number of closely eaten strips about 8 ft. wide extending throughout the length of the experimental area—a condition not found anywhere else in the whole paddock, while bounding them the grass and clover, of apparently first-class quality, was from 8 in. to 9 in. high. Had these particular plots been kept continuously mown during the spring they could not have appeared more striking. The close-cropped condition was obviously not due to lack of vigour, as evidenced by the colour, &c., but to the voluntary heavy grazing of the stock. The plots so favoured by the stock were those to which superphosphate had been applied, and probably the preference shown may be attributed to the rapid action of the super in promoting early and vigorous spring growth. Thus as the vigorous growth continued the stock, finding the young pasture more succulent, would pay more attention to these particular areas. The basic-super plots also attracted particular attention from stock, but were grazed to a lesser extent than the super. It would not be surprising to find that the plots were grazed in proportion to the percentage of readily available phosphates in the different fertilizers applied. The slag, Ephos, and control plots, together with the remainder of the field, appeared to receive equal attention from the stock.

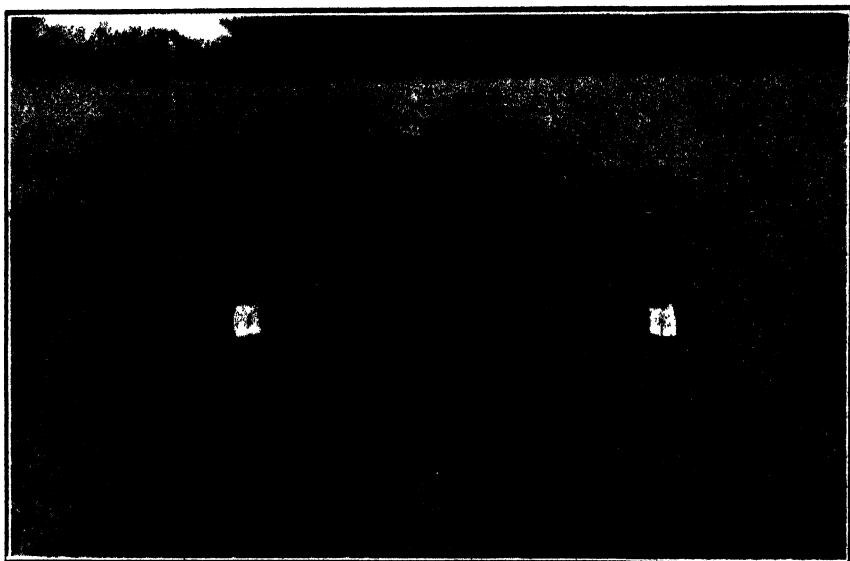


FIG. 1. SHOWING CLOSE GRAZING OF SUPERPHOSPHATE-DRESSED PLOT ON MR. GILDEA'S FARM, MAHARAHARA.

The strip in centre is the super plot; on left is basic slag, and on right a control (unmanured) plot, both comparatively neglected by stock.



FIG. 2. ANOTHER SUPERPHOSPHATE PLOT (CENTRE), WITH CONTROL ON LEFT AND EPHOS ON RIGHT.

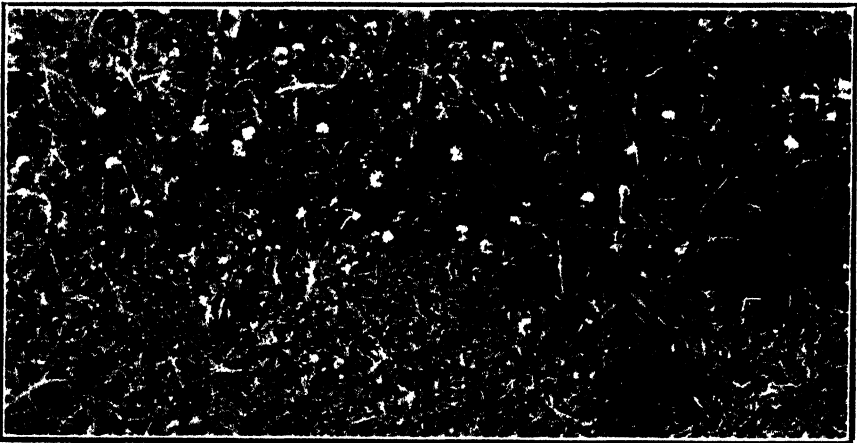


FIG. 3. NEAR VIEW EARLIER IN SEASON WHEN CLOVER WAS FLOURISHING.

Superphosphate in foreground, basic slag at back. Both plots containing abundant clover, but super well grazed.

These observations were confirmed in a similar test on Mr. Norman Inder's farm at Piripiri, Dannevirke, where the pasture had also been lightly stocked with dairy cows. Here also the basic-super plots had been eaten to a lesser extent than the super areas, while the remaining plots, although of apparently the same botanical composition, were neglected.

It should be clearly understood that the foregoing observations were only possible in those few instances where understocking permitted the

animals to discriminate. In all the other observation areas laid down, where the stocking did not permit surplus growth the various effects from manures which could be discerned by colour, condition, &c., gave similar impressions.

GREEN-WEIGHT EXPERIMENTS.

In addition to these observation plots experiments were laid out in three localities—Rongotea, Rangiotu, and Rangiwhia—on three very different types of soil. The areas selected were hay-paddocks, two of which had been cut fairly consistently for eight and twelve years respectively, and had never received any manurial treatment previously. The object of these experiments was to obtain definite figures of the effects of manures by recording the green weights from a given area of each plot. A “green weight” is taken within a few minutes of mowing and before any drying has occurred, while the crop is being cut for hay. When weights are to be compared they must necessarily represent the yield from equal areas, and, to ensure this, in each case the mowing-machine was driven down the centre of each plot, thus ensuring that all cuts were of even widths. Each swath was then measured into half-chain lengths and immediately weighed. A number of interested farmers were present in each case, and all were emphatic in their opinion that the methods adopted were as accurate and reliable as possible.

In the accompanying tables of results the last column gives an indication of the odds in favour of the increase due to the varying treatments being correct or statistically “significant.” The odds refer only to the increase of the treatment over no treatment. Another examination of weights would be required to determine definitely the relative value of the manures, although in both Martin’s and Parker’s experiments superphosphate is distinctly in advance of any of the other manures. It must be realized that the odds are not based solely on the quantity of increase, but also on the natural variation which has occurred in the weights recorded. Thus it is seen that in Parker’s weights 1 ton of lime per acre appears to have increased the yield by 8 cwt., but as the odds are “non-significant” this increase cannot definitely be attributed to lime.

COMMENTS ON TABULATED RESULTS.

From the tabulated results it will be seen that superphosphate has produced more growth than any other treatment. Slag, Ephos, and basic super yield so closely that there is not sufficient difference to distinguish between them without further statistical examination, although, beyond doubt, each has improved the yield of the untreated paddock. Only in one case (H. Bond, Rangiotu), on land which was waterlogged throughout the winter, is there any increase in yield which one is justified in attributing to the addition of lime. Although lime alone has decreased the yield, the addition of lime to superphosphate has almost doubled the gain produced by that manure alone. This may possibly be accounted for by the fact that the ground in question is of a somewhat peaty nature, and was very sodden in consequence of the extremely wet conditions prevailing in the Manawatu district last winter and late into the spring. Under these conditions there would

probably be an accumulation of soil-bases which would form insoluble compounds with a part of the phosphates. The addition of lime presumably releases the phosphate in a number of these compounds, and so makes more phosphates available for the plant. While the results recorded on these (Bond's) plots are quite reliable under the wet conditions prevailing last winter, they may probably be at variance with results securable in an average year. Slag and Ephos are slower-acting manures and act better where a fair percentage of soil-acidity is present. This is shown in the case of Ephos on Bond's plots, where, on a soil of a peaty nature, it produced an increase as large as that given by super. A difference is seen, however, where the Ephos plots had an addition of lime. Not only here, but in every case lime appears to have reduced the yield of Ephos. The failure of slag to show a significant increase on Bond's plots is very interesting, and justifies further investigation.

Table 1.—Results on Farm of H. Bond, Rangitū.

Treatment.	Number of Plots paired.	Yield per Acre in Green Weight.	Difference in Favour of Treatment over no Treatment	Percentage of Increase.	Difference Significant or Non-significant.*
<i>Manures only.</i>					
No manure ..	13	T. cwt. qr. lb. 6 17 1 16	T. cwt. qr. lb.		
Super, 3 cwt. per acre ..	..	7 13 0 12	0 15 2 24	11.43	S
No manure ..	15	6 18 0 11			
Slag, 3 cwt ..	..	7 7 2 3	0 9 1 20	6.82	N.S.
No manure ..	14	6 4 3 2			
Basic super, 3 cwt. ..	..	6 15 3 5	0 11 0 3	8.84	S.
No manure ..	15	6 2 2 8			
Ephos, 3 cwt ..	..	6 16 2 3	0 13 3 23	11.38	S.
No lime ..	12	6 10 1 5			
Lime, 1 ton ..	..	6 2 1 21	0 7 3 12†	6.09†	S.
<i>Manures and Lime.</i>					
No manure ..	14	6 6 3 7			
Super, 3 cwt., and lime, 1 ton per acre ..	..	7 12 1 22	1 5 2 15	20.21	S.
No manure ..	18	6 10 1 11			
Slag, 3 cwt., and lime, 1 ton ..	..	7 3 0 2	0 12 2 19	9.71	S
No manure ..	17	6 8 1 9			
Basic super, 3 cwt., and lime, 1 ton ..	..	7 2 3 22	0 14 2 13	11.38	S.
No manure ..	18	6 2 3 3			
Ephos, 3 cwt., and lime, 1 ton ..	..	6 12 3 24	0 10 0 21	8.30	S.

* A difference is regarded as "significant" only when the chances are 30 to 1 or more in its favour is computed under the statistical method of examination

† Decrease.

Apart from Bond's results, which are from a soil recognized as differing considerably from the average, the results obtained are not unexpected, and, taken in conjunction with those of other experimenters, lead one to ask whether the manurial responses from normal average types of soil met with are as different as some farmers believe. The suggestion that the results will usually be in the same proportion whether the manure is applied to river-silts, loams, or average hill-country may have some foundation. Undoubtedly there are exceptional types—as, for example, light sand country, peaty swamps, pumice lands, &c.—which would not be regarded as average soils and which, quite naturally, might require special consideration.

From the record of Parker's and Martin's weights it will be noticed in each case that the increase due to super amounted to 2 tons per acre of green material. This increase occurred in both cases as a result

Table 2.—Results on Farm of J. Parker, Rongotea.

Treatment.	Number of Plots paired.	Yield per Acre in Green Weight.	Difference in favour of Treatment over no Treatment.	Percentage of Increase.	Difference Significant or Non-significant.
<i>Manures only.</i>					
No manure ..	18	T. cwt. qr. lb. 6 3 2 4	T. cwt. qr. lb.		
Super, 3 cwt. per acre ..	..	8 6 0 5	2 2 2 1	34.41	S.
No manure ..	18	6 4 2 14			
Slag, 3 cwt. ..	..	7 10 0 27	1 5 2 13	20.55	S.
No manure ..	18	6 4 1 9			
Basic super, 3 cwt. ..	..	7 16 2 4	1 12 0 23	25.90	S.
No manure ..	18	6 3 0 26			
Ephos, 3 cwt. ..	..	7 10 1 21	1 7 0 23	22.08	S.
No lime ..	21	6 4 0 6			
Lime, 1 ton ..	..	6 12 2 4	0 8 1 26	6.83	N.S.
<i>Manures and Lime.</i>					
No manure ..	18	6 3 2 4			
Super, 3 cwt., and lime, 1 ton per acre ..	..	8 9 0 4	2 5 2 0	36.83	S
No manure ..	18	6 4 2 15			
Slag, 3 cwt., and lime, 1 ton ..	..	8 0 0 4	1 15 1 17	28.40	S.
No manure ..	18	6 4 1 21			
Basic super, 3 cwt., and lime, 1 ton ..	..	8 9 3 11	2 5 1 18	36.42	S.
No manure ..	18	6 3 0 26			
Ephos, 3 cwt., and lime, 1 ton ..	..	7 2 2 3	0 19 1 5	15.24	S.
No manure ..	7	6 18 1 14			
Cow-manure, 15 tons per acre (approx.) ..	..	8 10 3 4	1 12 1 18	23.42	S.

of closing these paddocks for a period of eleven and a half weeks ; and the question arises, What would this increase mean to a dairy-farmer ? As a number of farmers will rightly or wrongly consider that a 2-ton increase is beyond the capability of their own particular paddocks, we reckon on the conservative assumption that an increase of at least 25 cwt. (green weight) may be expected. Reliable data show that 1 ton of average good pasture may be expected to produce not less than 14 lb. of butterfat. (A. H. Cockayne, in this *Journal* for August, 1921.) At current prices the return from 3 cwt. of super applied is therefore 17½ lb. of butterfat at, say, 1s. 2d. per pound, or £1 os. 5d. ; and this for a period less than three months, leaving the remaining nine months as clear profit. If manure is applied at present prices—say, £5 10s. per ton on the farm—the cost of 3 cwt. per acre would be 16s. 6d., and even with butterfat at only 1s. 2d. per pound the outlay and more would be returned before January.

The next question that arises is, Does it pay to top-dress annually ? In the absence of definite data the following theory is offered : Without

Table 3.—Results on Farm of M. Martin, Rangitahia.

Treatment.	Number of Plots paired.	Yield per Acre in Green Weight.	Difference in Favour of Treatment over no Treatment	Percentage of Increase.	Difference Significant or Non-significant.
<i>Manures only.</i>					
		T. cwt. qr. lb. ' T. cwt. qr. lb.			
No manure ..	25	5 0 0 5			
Super, 3 cwt. per acre ..	..	7 0 1 14	2 0 1 9	40·31	S.
No manure ..	24	4 13 3 21			
Slag, 3 cwt. ..	..	6 3 1 17	1 9 1 24	31·36	S.
No manure ..	24	4 13 3 21			
Basic super, 3 cwt. ..	..	6 7 1 21	1 13 2 0	35·66	S.
No manure ..	24	5 3 2 18			
Ephos, 3 cwt. ..	..	6 13 2 8	1 9 3 18	28·85	S.
No lime ..	28	4 16 3 17			
Lime, 1 ton ..	..	5 2 1 6	0 1 5 17	5·57	N.S.
<i>Manures and Lime.</i>					
No manure ..	35	4 18 1 16			
Super, 3 cwt., and lime, 1 ton per acre ..	..	6 10 3 22	1 12 2 6	33·08	S.
No manure ..	35	4 16 0 25			
Slag, 3 cwt., and lime, 1 ton ..	..	6 1 0 23	1 4 3 26	25·95	S.
No manure ..	36	5 3 1 5			
Basic super, 3 cwt., and lime, 1 ton ..	..	6 3 3 23	1 0 2 18	20·00	S.
No manure ..	36	5 5 2 22			
Ephos, 3 cwt., and lime, 1 ton ..	..	5 15 1 13	0 9 2 19	9·14	N.S.

a further application of manure in the second season, and continuing on the same conservative basis, the residue of the previous application could safely be expected to give half the increased weight of the first year—namely, $12\frac{1}{2}$ cwt. Now if, during the second year, a further 3 cwt. of super is applied, is it not reasonable to again expect an increase of 25 cwt.? This, with the increase from the residue of the previous year, would amount to $37\frac{1}{2}$ cwt. due to annual top-dressing; or, in terms of butterfat at 1s. 2d. per pound, it gives a return of £1 10s. 6½d. for a further expenditure of 16s. 6d. These figures deal with a period of only three months, and though they are based on 62.5 per cent. of the actual increase recorded in the experiments, they show that manuring pays handsomely. No allowance has been made for the increased grazing which would be expected during the remaining nine months of the year.

So far the evidence furnished by the foregoing experiments is not at variance with the results obtained by other investigators, and appears to favour the use of the more readily available fertilizers. The farmers who so ably co-operated with the Department, realizing the value of such work, have voluntarily offered facilities for continuing the experiments on their respective farms, thus enabling further data to be accumulated next season.

FOOT-ROT IN SHEEP AND ITS TREATMENT.

T. A. BLAKE, M.R.C.V.S., Veterinarian, Auckland.

THE cause of foot-rot in sheep is the toxin or poison secreted by certain micro-organisms which have gained entrance to the affected foot. The predisposing or contributory causes are: (1) An injury to the soft tissues between the claws, seen especially when the sheep are depastured on long rank grass, or on ploughed land where particles of grit may easily find their way into the inter-digital space and cause abrasion or injury, however slight, to the soft tissues in the cleft; (2) a weakening of the horny substance of the foot by excessive moisture, seen especially in wet seasons, at periods when heavy dews are prevalent, and on wet land.

The methods of treatment of foot-rot may be classed under two main headings—hand dressing and foot-bath treatment; but the essential operation common to both these methods is the proper and thorough trimming of the foot before any medicinal dressing is applied. Trimming of a foot consists in cutting away all overgrown horn, especially that part of the wall which becomes bent inwards over the sole, and in removing all loose or diseased horn, besides any dead or decaying tissue. A pair of cutters is useful in the quick trimming of the overgrown wall. The aim of the operator should be to allow the drainage of pus from the lesion, with as little removal of healthy tissue as possible, the cutting not being carried deep enough to allow the escape of much blood.

After the feet have been trimmed the application of an antiseptic and astringent dressing should be undertaken. When only small numbers of sheep have to be treated hand dressing is usually practised, and for this purpose there are several good drugs available whose successful action has been proved during many past years. Ointments are useful on account of their prolonged action, the one recommended

being made up as follows : Over a *slow* fire mix powdered bluestone, one part ; lard, one part ; and Stockholm tar, two parts. The foot should be dry for the proper application of an ointment. Other preparations in use are tincture of iodine, carbolic acid (one part to twenty of water), and sheep-dip. For severe cases butter of antimony may be applied with a feather or small brush, taking great care in its use because of its caustic properties. This is especially useful where fungoid growths resembling proud flesh are in evidence.

When large numbers have to be dealt with it is necessary to pick out the sheep badly affected, so that more constant attention may be given to them than to the flock generally. For the latter a foot-bath is recommended. This should be built of concrete or wood, either permanently with fixed rails or placed in position with hurdles to act as guides. It should be in the form of a trough 12 ft. long, 18 in. wide, and 6 in. high ; or a portion of the yard may be concreted, with the edges of the concrete raised a few inches to hold the solution. This latter plan is a good one, in that sheep can be stood in the solution for a few minutes while the remainder of the animals are being prepared. A thin layer of wool may be laid on the floor of the trough to prevent splashing.

According to the strength and nature of the solution, the time of immersion should range from one to a few minutes—allowing only one minute for poisonous baths, and, say, five minutes for the bluestone mixture. There is no need for more solution in the bath than will just cover the feet of the sheep. For poisonous baths it is necessary to provide a yard for drying, in order to prevent mortality from the ingestion of grass contaminated with the poisonous ingredients.

The bath solutions recommended are as follows :—

(1) Bluestone dissolved in water at the rate of 4 oz. to 1 gallon. Double this strength may be used on cases which need a greater caustic action. Bluestone is cheap, non-poisonous, fairly easily dissolved, and has been found quite efficacious.

(2) Arsenic dissolved in water in the following manner and proportions : Over a *slow* fire heat 1 lb. white arsenic, 1 lb. carbonate of soda, and 1 gallon water until the arsenic is dissolved. Add 5 gallons of water to make the mixture ready for use. When using this solution sheep should be walked through and not stood in the bath. Arsenic is poisonous, so must be carefully handled, and the possibility of ingestion by stock or human beings avoided.

(3) The various sheep-dips and foot-rot cures on the market, made up according to directions, should also be quite successful.

Whatever particular medicament is used as a dressing, it must be borne in mind that drainage of the foot is necessary, and, with that object in view, careful and thorough trimming is essential. The frequency of any form of treatment must be decided by the proportion of animals affected and by the severity of the individual cases. Bad cases need attention every second or third day, while once a week is not too often for a walk through the bath when a flock is seriously affected.

Having regard to the causes of foot-rot it will be recognized that sheep should be put into the driest paddocks available, and especially into such paddocks as will provide an opportunity for the normal wear of the horny part of the foot. As in other diseases, prevention is better than cure.

COVERED SMUT OF BARLEY AND ITS CONTROL.

J. C. NEILL, Field Mycologist, Biological Laboratory, Wellington.

COVERED SMUT is one of the commonest and most destructive diseases of barley in New Zealand. This year in Marlborough twenty-three out of forty-nine crops, and in Canterbury fifty out of sixty-nine crops examined were infected, the loss varying from a few heads to a third of the crop. The disease is carried from one year to the next entirely on the seed; so that if seed free from infection is sown no smut will develop in the crop. Naturally, clean seed is rare, since, even from a clean crop, it is likely to be contaminated during threshing and

cleaning. Therefore all seed should be disinfected before sowing. Any grower who neglects to disinfect his seed, however clean it appears to the eye, is almost sure to find smut in his crop. He may lose only a few heads, or, as in the case of the two lines of Plumage barley used in the experiments here detailed—which were sown as they came from the cleaning plant and without artificial infection—he may lose 30 to 40 per cent. of his crop and render the remainder quite unfit for malting purposes.



COVERED SMUT OF BARLEY.

[Photo by H. Drake.]

METHODS OF CONTROL.

The use of formalin provides the most efficient practical method of seed-disinfection for the control of covered smut, using either the "steep" or the "sprinkle" method. If a suitable container is available—formalin does not attack metals, wood, or concrete—the steep method is preferable, and should be carried out as follows:—

Make up sufficient solution by mixing commercial formalin (as purchased) with water at the rate of 1 pint of formalin to 30 gallons. Measure the quantities accurately, and do not add a little more formalin "for luck." The sacks of seed barley—which should not be more than one-third full, and sewn rather than tied—are dipped under the solution for ten minutes, and the grain moved about within the sack several times while under. After ten minutes' immersion each sack is

hoisted out, allowed to drain back into the trough, and then spread out singly on the ground or floor to dry out. If the dipping is done overnight the seed will be dry enough to sow on the following day. The grain will have increased about 20 per cent. in size, and allowance must be made for this in adjusting the seeder. The same solution may be used throughout, filling up, when too low to cover the sacks, with fresh solution previously prepared in the same proportions. Do not empty the treated grain into other sacks unless these have been soaked in the solution.

If a suitable trough is not available the sprinkle method may be used. With this method the seed barley is emptied out in a heap on a tight floor, and the formalin solution—previously made up accurately in the proportion of 1 pint to 30 gallons—is sprinkled over it from the rose of a watering-can. The heap should be shovelled over at least three times while under the sprinkle, to ensure that every grain is thoroughly wetted by the solution. The heap is then covered overnight by sacks soaked in the solution, care being taken that there is good drainage away from the heap so that the bottom layers do not lie in a pool of the liquid.

Bluestone (copper sulphate) may be used instead of formalin, the procedure being the same, but using a solution strength of 1 lb. of bluestone to 10 gallons water. Bluestone, however, does not control covered smut so effectively as does formalin, and is more apt to lower the vitality of the seed.

The hot-water method, while invaluable in cleaning up a line for stud-seed purposes, is not adapted to general farm use.

EXPERIMENTS ON CONTROL.

Three lines of naturally infected barley were used in the 1926-27 experiments—two being lines of Plumage grown on different farms in Canterbury, and the third being a line of Cape grown at the Central Development Farm, Weraroa.* All were sown from 9th to 12th September, 1926; the first, or germination, count was made on 19th to 21st October, and the whole were finally pulled and counted from 1st to 4th February, 1927. A spell of heavy rain, followed by drying winds after sowing, caked the ground, so that the plants had difficulty in pushing through, and as a result germination counts were irregular, with a high probable error.

Summary of Results presented in Table 1.

(1) Copper carbonate dust, Semesan dust and steep, Uspulun steep, and Clarke's Wheat Protector failed to disinfect completely.

(2) Bluestone 1 per cent. and 2 per cent. controlled covered smut in the Cape and Odger's Plumage, but failed to do so in Beck's Plumage. Germination was seriously lowered by the 2-per-cent. solution with Odger's Plumage only.

(3) Formalin at 1-240 (1 pint to 30 gallons), 1-320 (1 to 40), and 1-480 (1 to 60) gave complete disinfection, with the exception of one plant of Beck's Plumage. Germination and total heads were higher in all three than in the untreated controls.

* Samples kindly supplied by Mr. C. H. Hewlett, Manager, Canterbury Seed Co., and Mr. J. F. Shepherd, Manager, Central Development Farm, Weraroa.

6 hr. at 60°, 5 min. at 127°	92.0	58.0	2.33	53.2	213	0	0.0	1.039	0	0.0	90.0	53.7	2.39	53.0	212	0	0.0	1.307	0	0.0	87.0	88.0	0.98	82.0	326	0	0.0	1.149	0	0.0
6 hr. at 60°, 5 min. at 129°	86.5	51.5	1.88	49.5	168	0	0.0	.911	0	0.0	86.5	55.5	2.34	53.2	213	0	0.0	1.230	0	0.0	91.0	84.0	1.23	80.5	322	0	0.0	1.123	0	0.0
Control ..	96.5	81.5	1.58	79.0	316	48.15	2	1.056	18	0.0	97.0	80.7	2.26	77.7	311	85.27	3	1.538	347	22.5	..	78.5	75.2	301	32	10.6	1.135	106	9.3	
6 hr. at 80°, 5 min. at 121°	92.5	64.0	2.67	60.5	242	1	0.1	1.042	5	0.5	96.5	55.0	1.81	54.7	219	2	1.01	1.375	9	0.6	91.0	80.2	1.25	74.5	298	0	0.0	1.079	0	0.0
6 hr. at 80°, 5 min. at 123°	92.5	70.0	1.52	65.7	263	1	0.1	1.070	1	0.1	91.0	57.0	1.86	53.0	212	0	0.0	1.284	0	0.0	92.0	70.7	1.24	69.5	278	0	0.0	.978	0	0.0
6 hr. at 80°, 5 min. at 125°	88.0	62.5	1.91	60.5	242	1	0.1	1.070	7	0.6	91.0	50.2	2.23	48.2	163	0	0.0	1.277	0	0.0	91.0	74.7	1.15	72.2	289	0	0.0	.987	0	0.0
6 hr. at 80°, 5 min. at 127°	83.0	67.2	1.72	64.2	257	1	0.1	1.134	2	0.2	91.5	63.7	1.89	61.7	247	0	0.0	1.315	0	0.0	92.0	70.2	1.22	72.7	291	0	0.0	1.040	0	0.0
6 hr. at 80° 5 min. at 129°	82.5	52.7	1.82	52.2	209	0	0.0	.918	0	0.0	81.0	52.7	1.89	52.5	210	0	0.0	1.135	0	0.0	79.5	76.7	1.82	70.2	281	0	0.0	1.015	0	0.0
Control ..	95.5	64.7	1.80	62.5	250	82.32	0	1.032	278	26.0	96.0	74.7	1.97	72.2	280	89.30	8	1.150	315	27.4	..	79.0	73.3	77.5	310	23	7.4	1.104	74	6.7
6 hr. at 60°, 10 min. at 119°	92.5	56.7	2.18	55.2	221	0	0.0	1.008	0	0.0	90.0	65.7	1.65	62.7	251	0	0.0	1.007	0	0.0	86.0	80.7	1.24	87.0	318	0	0.0	1.109	0	0.0
6 hr. at 60°, 10 min. at 121°	90.0	57.5	2.07	56.7	227	0	0.0	1.076	0	0.0	98.0	71.2	1.61	69.5	278	0	0.0	1.053	0	0.0	88.0	87.7	1.09	82.7	331	0	0.0	1.024	0	0.0
6 hr. at 60°, 10 min. at 123°	90.0	63.7	1.07	64.5	258	1	0.4	1.180	2	0.2	95.5	60.5	2.39	10.7	243	0	0.0	1.050	0	0.0	78.0	87.5	1.02	84.2	337	0	0.0	1.071	0	0.0
6 hr. at 60°, 10 min. at 125°	87.5	60.7	2.04	57.0	228	0	0.0	1.061	0	0.0	95.0	54.5	1.52	51.5	206	0	0.0	1.118	0	0.0	90.5	86.2	1.14	81.2	325	0	0.0	1.048	0	0.0
6 hr. at 50, 10 min. at 127°	77.0	72.5	1.52	70.5	282	1	0.3	1.117	1	0.1	93.5	49.0	1.81	49.0	106	0	0.0	1.148	0	0.0	94.5	88.0	1.16	82.7	331	0	0.0	1.102	0	0.0
Control ..	96.5	55.7	2.62	51.7	207	61.29	5	1.020	211	21.0	98.5	71.0	1.73	69.7	279	92.33	0	1.468	492	33.5	84.2	1.70	81.7	327	29	8.8	1.261	47	7.7	
10 min. at 125°	96.0	72.7	1.68	71.0	284	0	0.0	1.242	0	0.0	97.2	69.0	2.00	65.0	260	0	0.0	1.329	0	0.0	95.5	81.7	1.10	78.7	315	0	0.0	1.287	0	0.0
10 min. at 127°	91.0	78.2	1.15	75.0	300	1	0.3	1.118	0	0.5	96.0	71.5	1.88	74.0	206	0	0.0	1.400	0	0.0	96.0	78.7	1.65	76.0	304	0	0.0	1.260	0	0.0
10 min. at 129°	93.5	71.2	1.92	69.5	278	1	0.3	1.049	0	0.1	95.5	71.5	1.41	71.2	285	0	0.0	1.534	0	0.0	80.5	80.5	1.08	78.2	313	0	0.0	1.131	0	0.0
10 min. at 131°	91.5	66.7	1.89	63.7	255	0	0.0	1.073	0	0.0	98.0	74.0	1.65	62.2	277	0	0.0	1.405	0	0.0	79.5	84.2	1.24	83.2	333	0	0.0	1.141	0	0.0
10 min. at 133°	89.5	51.2	1.84	49.7	169	0	0.0	1.015	0	0.0	97.5	73.5	1.41	72.2	281	0	0.0	1.445	0	0.0	72.5	81.7	1.00	75.7	303	0	0.0	1.178	0	0.0
Control ..	97.5	56.0	1.78	55.2	221	80.10	3	1.135	321	28.0	97.5	74.0	1.50	71.0	201	85.28	7	1.409	371	26.5	94.5	81.0	1.30	76.2	305	23	7.5	1.281	92	7.2

(4) The hot-water method—presoaking for six hours at 60° and 80° F., followed by a dip of five minutes at 121° to 129° F., presoaking for six hours at 60° followed by a dip of ten minutes at 119° to 127°, and a dip without presoak of ten minutes at 125° to 133°—gave complete disinfection (excepting one plant at 121° for five minutes) with Cape and Odger's Plumage; but with Beck's Plumage, again, certain seeds seemed particularly resistant to disinfection. No advantage was apparent in using a presoak temperature of 80° rather than 60°, and, within the limits of the times and temperatures used, no material drop was apparent in germination or number of heads as compared with controls.

PASPALUM-SEED PRODUCTION IN NEW SOUTH WALES.

REPORTING on a visit to New South Wales in December last, Mr. T. H. Patterson, Instructor in Agriculture, Auckland, refers as follows to the paspalum-seed industry in the North Coast district, where most of the commercial production is centred:—

“Mr William Seccombe, of Coff's Harbour, with whose name paspalum-grass is so closely associated, showed me over the country around the Nambucca River, near Mackville, and thence to the valley of the Bellingen and the uplands adjoining that river; from there we travelled to Bondville and on to Coff's Harbour. The slate and schist formation of the Mackville hill-country, with its soils of fair quality, is of special interest to New Zealand, because from that district over 50 per cent of the paspalum-seed imported into the Dominion is harvested. The seed set by the grass yields a heavy shotty sample which germinates well, some of the best giving 70 per cent. and a little over in tests. Compared with seed from the alluvial areas of the Clarence, Richmond, and Tweed Rivers, and from the rich volcanic country near Lismore, it is much better if we judge by our present standards. About 100 tons of seed is sent annually to New Zealand

“The best seed is saved from pastures which have been grazed down hard until about the end of December or, alternatively, mown to effect the same result. Then the pastures are shut up, as growth at that season of the year is rapid, and seed is set heavily and evenly. About 3 cwt to 4 cwt per acre is the usual yield per season.

“The following method is practised for taking ‘hand-shaken’ seed: A dish is suspended in front of the body of the harvester about level with the hips, and both hands are employed to draw in all heads, rub off, and drop into the dish the seed which is ripe. Paspalum-seed ripens unevenly, and therefore areas with heavy crops are gone over four to five times between February and April. The ripe seed is easily rubbed off by drawing the closed hand over a bunch of heads. A man will gather up to 100 lb of seed per day, and some few do 200 lb. The best samples weigh about 22 lb. per bushel.

“At the time of my visit the district had been suffering from a prolonged drought. The rains started on the day of my arrival, and I have learned since that copious falls continued for over a month. These conditions should make this season's seed, though a little late, of excellent quality—as far as weight indicates quality.”

INTERNATIONAL HORTICULTURAL CONGRESS, 1927.

It has been arranged to hold the next International Horticultural Congress at Vienna from 20th to 25th September next. The management will be in the hands of the Horticultural Society of Austria, whose centenary celebrations also take place this year, coinciding with the Congress. The last international congress of horticulture was held at Amsterdam in 1923, and the secretary of the permanent organization is Professor J. M. Sirks, Wageningen, Holland.

THE OTARI OPEN-AIR NATIVE-PLANT MUSEUM.

J. G. MACKENZIE, Director of Parks and Reserves, Wellington, and L. COCKAYNE, Honorary Botanist, New Zealand Institute of Horticulture.

Introduction.

WHEN, some eighty-seven years ago, the City of Wellington was founded most of the country in its immediate vicinity was clothed with noble forest. The pressing demand for timber and firewood, as also for farm lands, led by degrees to the destruction of nearly all this primitive tree-community, so that at the present time only a few isolated portions remain, for the most part greatly altered in structure, though some bear more or less their primitive stamp.

The best-known of these forest-remnants is that generally designated "Wilton's Bush." This, up till October, 1907, was the property of Maoris, but on that date the Government purchased the land from its Native owners, the Wellington City Council contributing £500 of the purchase-money. The area was forthwith proclaimed a scenic reserve, to be administered by a Board of seven members, of whom the Commissioner of Crown Lands for the Wellington District was to be chairman, and the chairman of the Reserves Committee of the Wellington City Council a member *ex officio*. But the Board could do little in the way of improving the reserve (making paths, fencing, &c.) through lack of funds; so in 1916 it passed a unanimous resolution requesting the Government to vest the reserve in the Wellington City Council. This position the Council would not accept unless the reserve became the property of the city. Finally, after negotiations had proceeded for some time, the reserve was handed over to the City Council in 1918 on their paying a further £700 for the property. Thus for the past nine years the reserve has been cared for by the Council, paths have been made, fences erected, the stream bridged, grazing within the precincts of the reserve forbidden, and the forest given a chance to slowly regenerate.

During the last two or three years more particularly—though really the need has been recognized for a long time—a strong feeling has arisen among those interested in the indigenous plants—no mean number of the public—that as complete a collection of such plants as possible should be established within easy reach of the centre of the city, where they could be enjoyed by the public and afford also material for study. This important matter was discussed at various times by the Council of the New Zealand Institute of Horticulture, but no definite steps were taken towards the desirable end. Eventually the City's Director of Parks and Reserves suggested in the daily Press that Wilton's Bush would be suitable for the purpose, and at some length he explained its value. This stimulus was exactly what the Institute of Horticulture required, and a deputation from that body, headed by its president, Mr. F. J. Nathan, waited on the Reserves Committee of the City Council and urged that the idea of the Director of Parks be adopted, pointing out at the same time what such meant to Wellington—and, indeed, to New Zealand. The Committee were most sympathetic, and promised to further the desirable project.

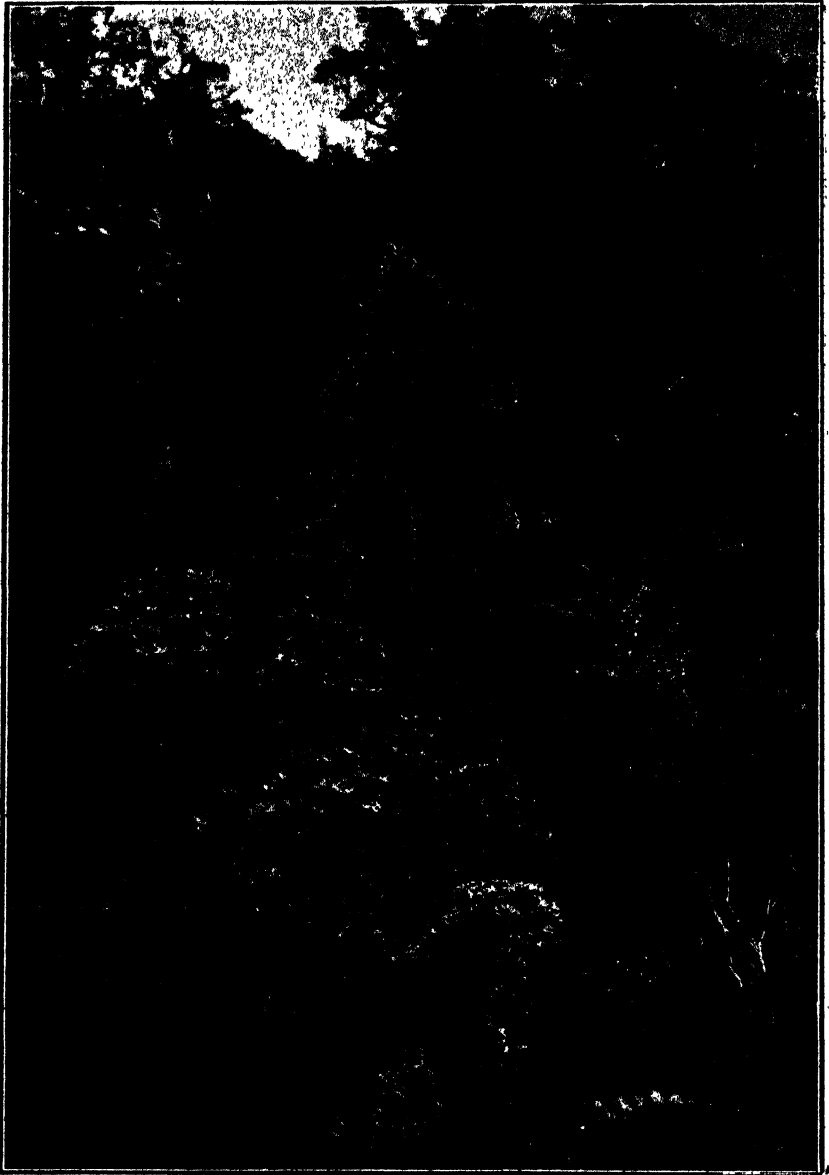


FIG. 1. PORTION OF THE ORIGINAL FOREST STILL ALMOST VIRGIN.

In centre the rewarewa (*Knightia excelsa*).

[Photo by H. Drake..

A few days later the Honorary Botanist of the Institute of Horticulture, acting on behalf of the Institute and with the approval of the Director of Parks, drew up a full report on the subject, which was submitted to the Reserves Committee and accepted by them in its entirety. This report appeared in full in all the Wellington daily papers; and it is the ideas embodied therein, and their explanation, which is the main motive of this article. In other words, we seek to put on permanent record the history of this important movement, which, as will be seen, is truly a national movement, also the plans for carrying it out as endorsed by the City Council and the Institute of Horticulture. Further, we may explain that the scheme has been the subject of various eulogistic articles in Great Britain, which have appeared in such authoritative publications as *Nature*, *The Garden*, *The Gardeners' Chronicle*, and *The Kew Bulletin*. Also, much help has been promised spontaneously by lovers of New Zealand plants in various parts of the Dominion.

As a preliminary to the great work in hand, His Worship the Mayor of Wellington, Mr. C. J. B. Norwood, arranged for an official opening of the Museum and invited the citizens and others to be present. Notwithstanding most inclement weather, there was a large gathering, including the Hon. J. Hawken, Minister of Agriculture, and the Hon. R. A. Wright, Minister of Education. Memorial trees (kauris, rimus, totaras, &c.) were planted by the Mayor and Mayoress, the Ministers of the Crown and their wives, and others. Interesting speeches were delivered, and the reserve itself was explored and its beauty admired; in short, a most important public movement was fairly launched, and the career began of the Otari Open-air Native-plant Museum—Wilton's Bush no longer.

The area occupied by the Museum is about 143 acres, perhaps one-half of which is occupied by forest, some of which is practically virgin (Fig. 1). Much of the area consists of fairly steep slopes, but there are many level places of considerable size (Fig. 2), and there is every variety of aspect—a most important feature. The lowest part consists of a valley through which flows the Kaiwharawhara Stream (Fig. 3), which is crossed by a bridge (Fig. 4) leading by a natural pergola (Fig. 5) into the heart of the reserve. The unforested portion (Fig. 2) is of special moment in regard to the scheme now to be outlined.

Scheme for dealing with the Reserve.

The scheme adopted (but of course subject to minor modifications) is fourfold. It is not designed for immediate application as a whole—that would be impossible, even if advisable—but it will take many years. Briefly, this fourfold treatment resolves itself into the following distinct subjects: (1) The flora, including both the systematic and biological sides; (2) the vegetation; (3) horticulture; (4) restoration of the forest. We deal with them in that sequence.

THE FLORA.

In regard to the flora of New Zealand, it is intended to introduce into the reserve as complete a collection as is possible of the species of flowering-plants and ferns to be found in the New Zealand botanical

region. These number about eighteen hundred, and rather more than three-fourths are found only in New Zealand; the remaining one-fourth also occur as wild plants in other countries, a large majority being Australian. It may be explained that the flowering-plants comprise the trees, shrubs, semi-woody plants, and annuals and herbaceous perennials.

The species will be arranged as far as practicable according to their families. We say "as far as practicable" advisedly, since in many cases certain species, so closely related to others that they belong to the same genus, cannot live under the same conditions as their fellows and must be grown under a different environment. For example, the pigmy-pine (*Dacrydium laxifolium*) of mountain moorland cannot be grown side by side with the giant rimu (*Dacrydium cupressinum*)—

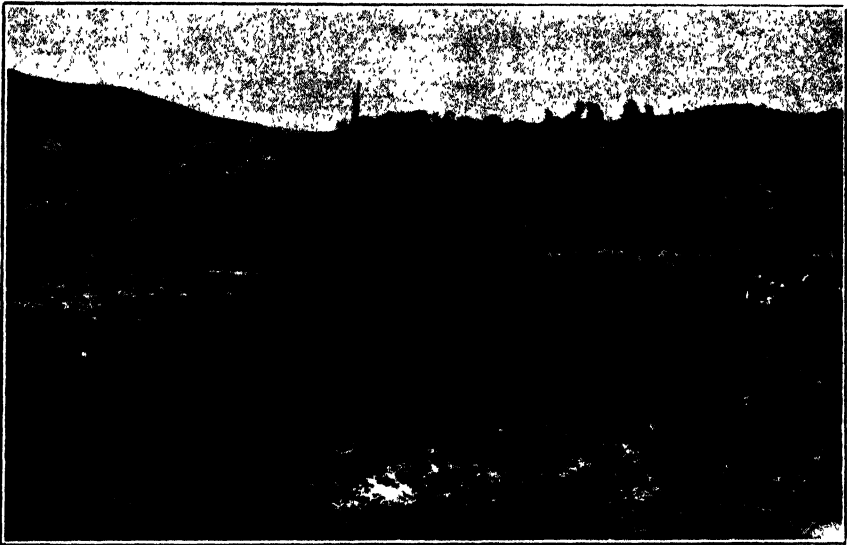


FIG. 2. ONE OF THE FLAT PORTIONS OF THE AREA, SUITABLE FOR PART OF THE SYSTEMATIC COLLECTION OF THE FLORA.

In the upper part of the view is seen damaged forest.

[Photo by H. Drake.

a forest-tree; nor can the lovely purple-flowered shrubby daisy of the Chatham Islands (*Olearia semidentata*)—a glorified Michaelmas daisy—be cultivated alongside its easily grown relatives of the subalpine scrubs. In short, botanical classification must not stand in the way of expediency, however much the herbarium botanist may look askance.

As well as the species, the hybrids between such will be cultivated, and their presence in cultivation will be of the greatest moment for the plant-classifier and the student of evolution. The number of such groups of hybrids in the New Zealand flora—usually great swarms of different-looking individuals—is probably considerably more than two hundred and fifty, most of which have only been known for the last two or three years. Of such one of the writers (L. C.) has dozens in his own garden waiting for their place in the Otari Museum.



FIG. 3. THE KAIWHARAWHARA STREAM AS SEEN FROM THE BRIDGE NEAR THE LOWER ENTRANCE TO THE OPEN-AIR MUSEUM.

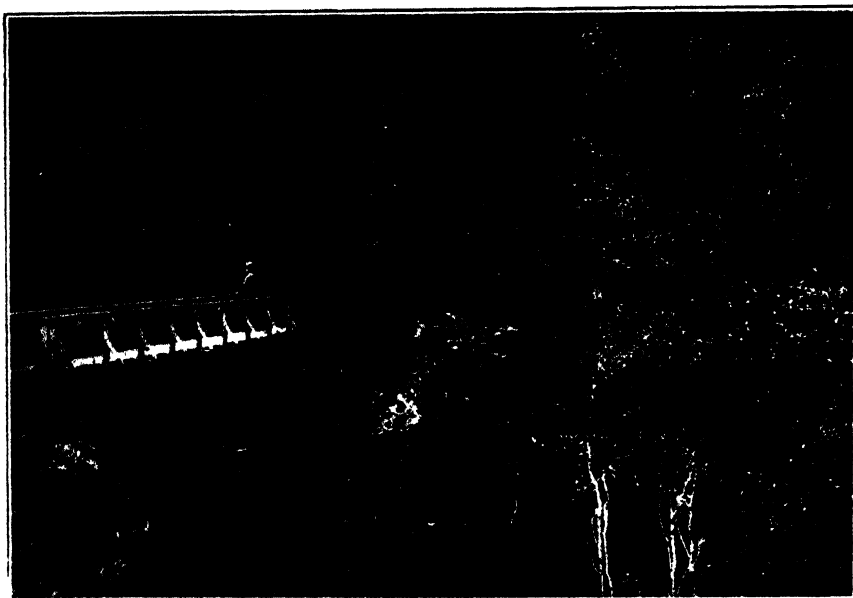


FIG. 4. THE FOOTBRIDGE OVER THE KAIWHARAWHARA AT THE LOWER ENTRANCE TO THE AREA.

To right and above greatly modified forest consisting largely of rangiora (*Brachyglottis repanda*).

[Photos by H. Drake.

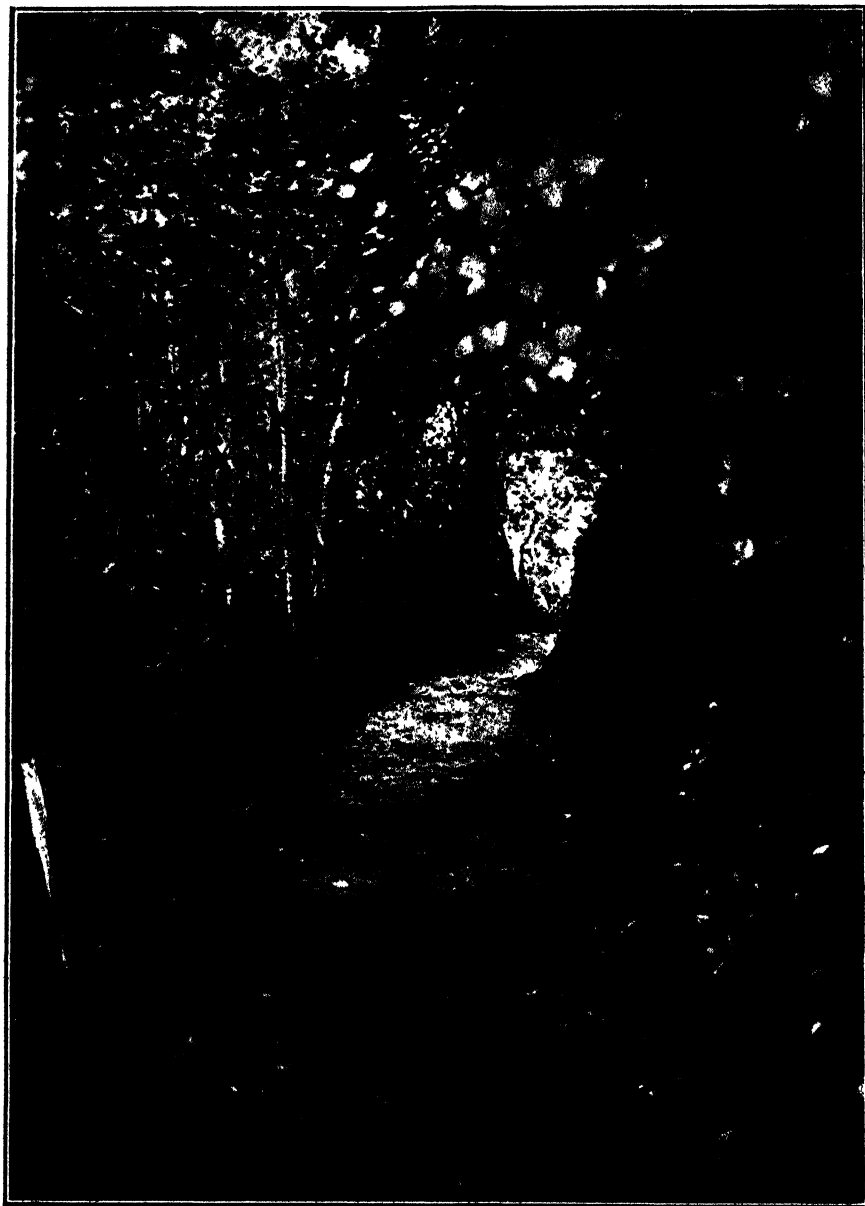


FIG. 5. THE NATURAL PERGOLA LEADING INTO THE CENTRE OF THE AREA.

[Photo by H. Drake.]

Each species in this systematic collection will be labelled accurately (the best botanical advice being always procurable), and in addition to its name will be appended its distribution in New Zealand and its habitat (the kind of place it naturally grows in—forest, swamp, dune, rock, &c.). Thus, when complete, almost the whole New Zealand flora will be seen at a glance, as it were, and the seasonal changes and other biological matters concerning each species can be observed.

It should go without saying that to have ready access to such an accurately labelled living flora will be of inestimable value for teachers and pupils, for nature-lovers, for professional botanists, as also for horticulture, agriculture, and forestry.

Besides being classified according to their relationships, plants can be grouped according to their forms, such being the outward expression of their relation to the places where they grow. Such forms are called "life-forms"—the forms, that is, upon the possession of which their very existence depends. In this regard New Zealand plants have much to tell, some of which is specially characteristic of the region. Collections of life-forms will be an interesting feature of the museum. Indeed, much of moment is there already. Thus, the climbing or liane form is greatly in evidence (Fig. 6); the possession of a long-persisting juvenile form distinct from that of the adult, as in the milk-tree (*Paratrophis microphylla*) and the mighty matai (*Podocarpus spicatus*) (Fig. 7); or the tussock form of many grasses, sedges, and even of the New Zealand flax (*Phormium tenax*).

THE VEGETATION.

More important than a classified living flora, and *something not yet attempted in any garden in the world*—and this is what makes the scheme unique—are to be representations of portions of the primitive vegetation of New Zealand. It must be clearly understood that the flora and the vegetation of a country are two quite different things. That is, the *flora* is concerned with the species merely as species, but *vegetation* with the combinations of species as they grow side by side, such combinations taken all together making the plant-covering of the land. Thus the flora of a region can be readily illustrated by dried plants in a herbarium, but the vegetation can be seen only in nature, or it can be represented by drawings or by photographs.

In nature plants do not grow haphazard, but they form well-defined communities, each more or less distinct from any other. So there are large communities, such as grassland, forest, shrubland, the plant-covering of boggy ground, of sand-dunes, and so on, and each of these may be subdivided into different smaller communities. Take forest, for instance: There is coastal forest with the karaka (*Corynocarpus laevigata*) dominant, or kauri (*Agathis australis*) forest, or southern-beech (*Nothofagus*) forest, or tawa (*Beilschmiedia tawa*) forest, to cite a few kinds. It is of such natural, virgin communities that artificial, accurate representations are to be attempted in the open-air museum. Thus it is hoped to be able to make a small piece of kauri forest and patches of other types of forest—for example, that of lowland Chatham Island. The subalpine scrubs of the high mountains, the manuka thickets of northern Auckland, the *Hebe* (koromiko) communities of

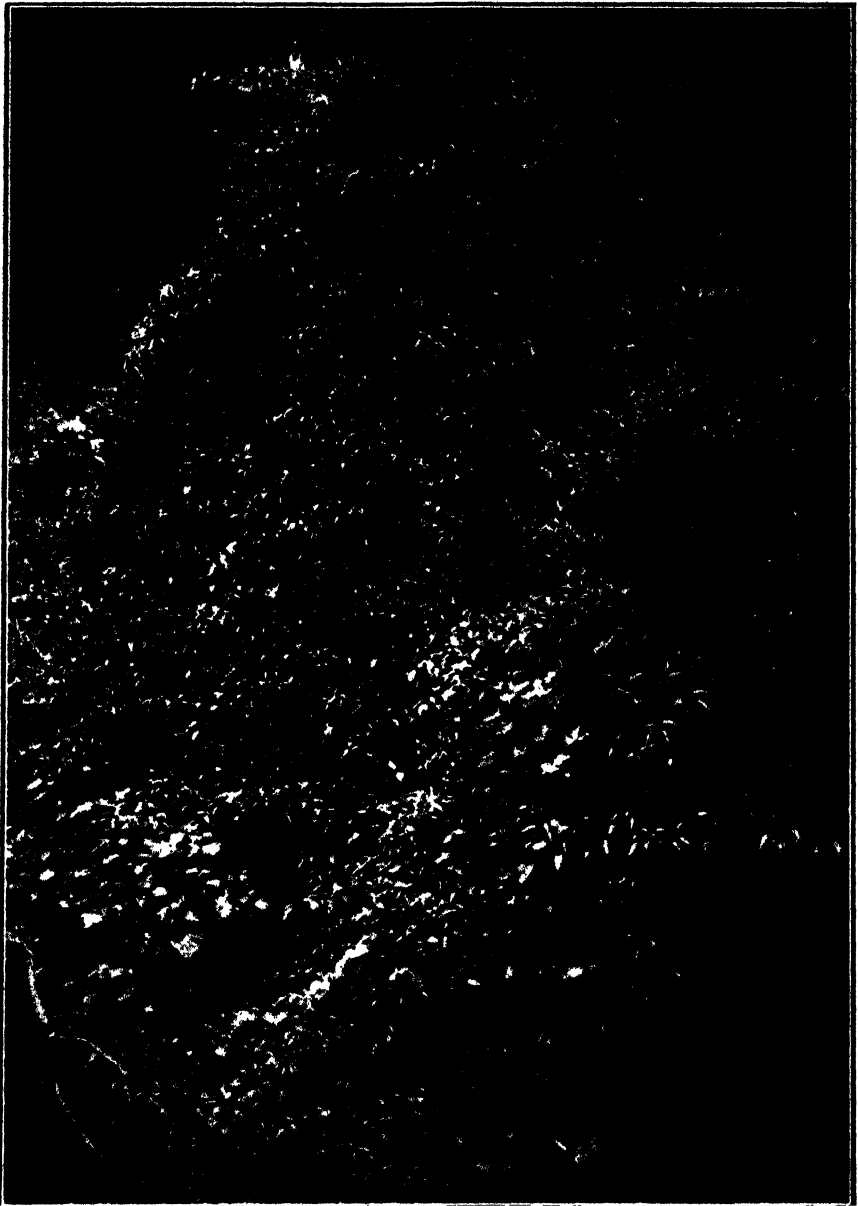


FIG. 6. THE LIANES—PASSION-VINE (*TETRAPATHAEA TETRANDRA*) AND BUSH-LAWYER (*RUBUS AUSTRALIS*).

[Photo by H. Drake.]

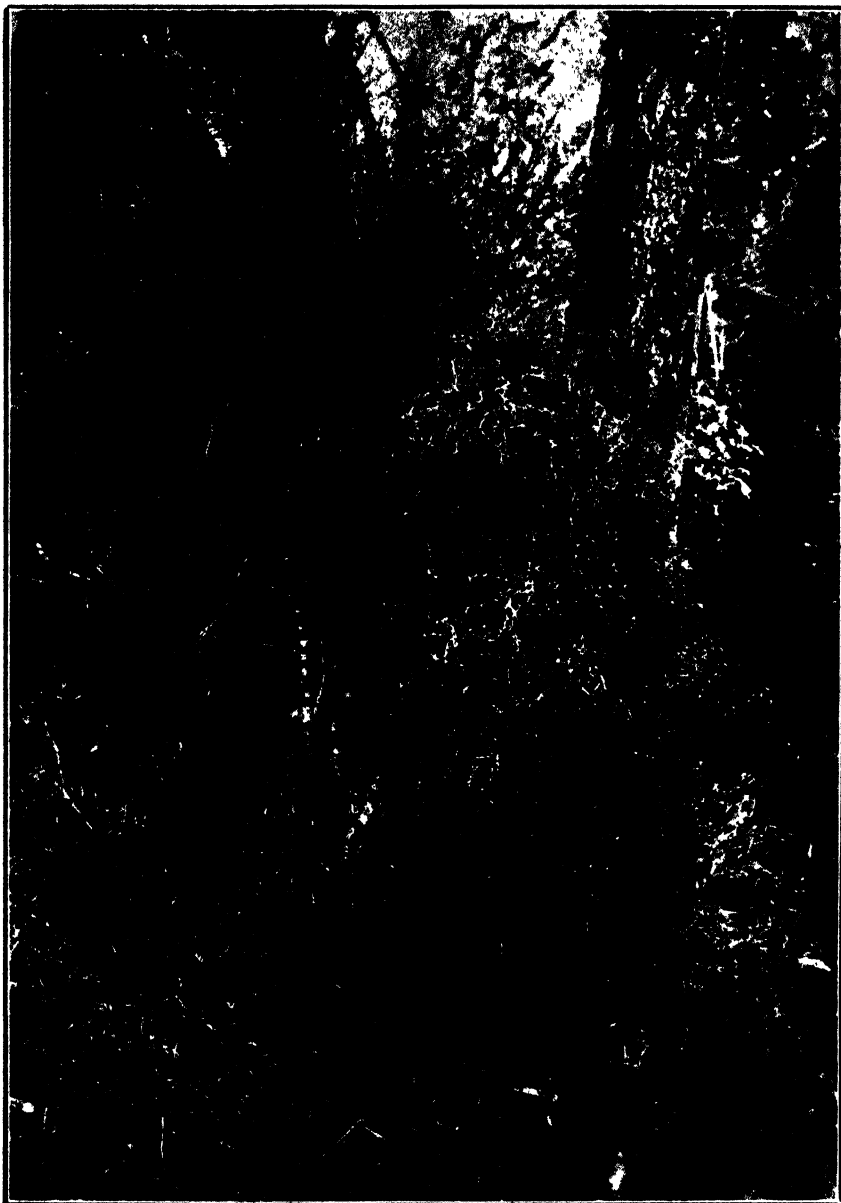


FIG. 7. ON RIGHT, JUVENILE MILK-TREE (*PARATROPHIS MICROPHYLLA*); ON LEFT, JUVENILE MATAI (*PODOCARPUS SPICATUS*).

[Photo by H. Drake.

Canterbury, the cliff vegetation of Marlborough (a cliff awaits its new garb) are a few communities among many others which may probably be easily imitated and successfully established.

In the Motherland, and indeed in Europe generally, to reproduce the virgin vegetation is impossible in the majority of cases, since there are no longer living examples of such communities. But in our land, though the face of nature is day by day being changed out of all recognition, fortunately most of the plant-communities can still be seen in their virgin state, but usually far from the beaten track. Moreover, many have been so described that models are available for the gardener, aided by the botanist, to copy. Thus by degrees primitive New Zealand, as it was before the white man, or possibly the Maori, came on the scene, may in time be brought back again and have its home in an actual city.

HORTICULTURE.

This part of the scheme is also of a distinctly novel nature. The idea is to illustrate what use can be made of New Zealand plants in horticulture. Many wish, nay long, to grow the plants of their native or adopted land, but they know neither which to grow nor how to grow them. Thus, there can be readily established groves (not isolated plants) of trees celebrated for beauty of flower or elegance of form—for example, pohutukawas (*Metrosideros tomentosa*), kowhais (species of *Edwardia*), lacebarks (species of *Hoheria*), the mountain-ribbonwoods (*Hoheria glabrata*, *H. Lyallii*), and cabbage-trees (*Cordyline australis*). Hedges of various species will be planted illustrating their relative value for the purposes of low or tall hedges and shelter-belts. Small gardens of native plants will be made in order to show what can be done with such by those with limited garden space.

An extremely important feature of this horticultural series will be a real alpine garden. Such can readily be formed on the banks of the stream (Fig. 8), and, judging from our experience in the cultivation near Wellington of New Zealand high-mountain species, the place selected should be an excellent one. We feel certain that most of the mountain-daisies (species of *Camisia*), the ourisias (species of *Ourisia*), and some of the large buttercups (species of *Ranunculus*) will grow admirably. Indeed, we are sanguine enough to believe that the famous mountain-lily (*Ranunculus Lyallii*) may become well established. This alpine garden will be one of the first pieces of work to be put in hand.

RESTORATION OF THE ORIGINAL FOREST.

Finally comes the question of how to deal with what remains of the "forest primeval." Here one essential point stands out clearly: this is that (with one proviso) no plant should be planted in the forest which was not originally in a similar plant-community of the neighbourhood. In certain places the forest is still intact (Fig. 1); there it must religiously be left alone. But in many places it is greatly altered from what it was originally (Fig. 9). Certainly nature is repairing the damage, but her methods are rarely rapid, nor would the new forest she is creating match her original handiwork. Man can do the work more rapidly, and, armed with scientific knowledge, can place in the forest, each in its proper situation, those species lacking or those not in sufficient numbers. Dozens of nikau-palms (*Rhopalostylis sapida*) will have to be

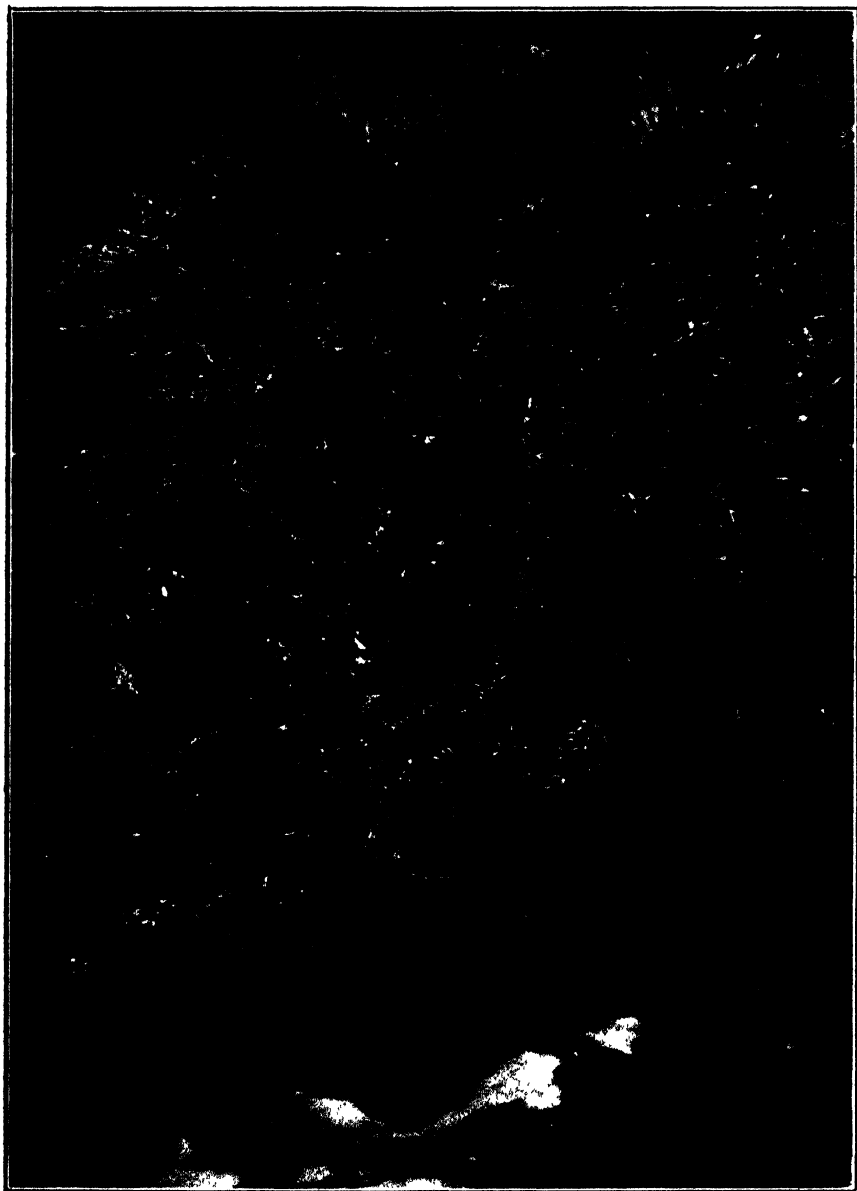


FIG. 8. PART OF THE SITE OF THE PROPOSED ALPINE GARDEN.

Photo by H. Drake

introduced ; so, too, with the podocarps and other tall forest-trees ; also the number of tree-ferns is insufficient, and the amount of rangiora (*Brachyglottis repanda*) too great. But a detailed survey of the forest is needed before rules for its restoration can be drawn up.

A proviso was attached to our statement in regard to planting nothing which was not originally in the forest. An attempt will be made to grow all the ferns of New Zealand (about one hundred and forty). Most will not grow in the open ; they must have shelter and shade within the forest. Therefore a gully will be set apart for the fern collection ; and there is one well suited for this purpose, easy of access, and in proximity to the site of the alpine garden. Here the

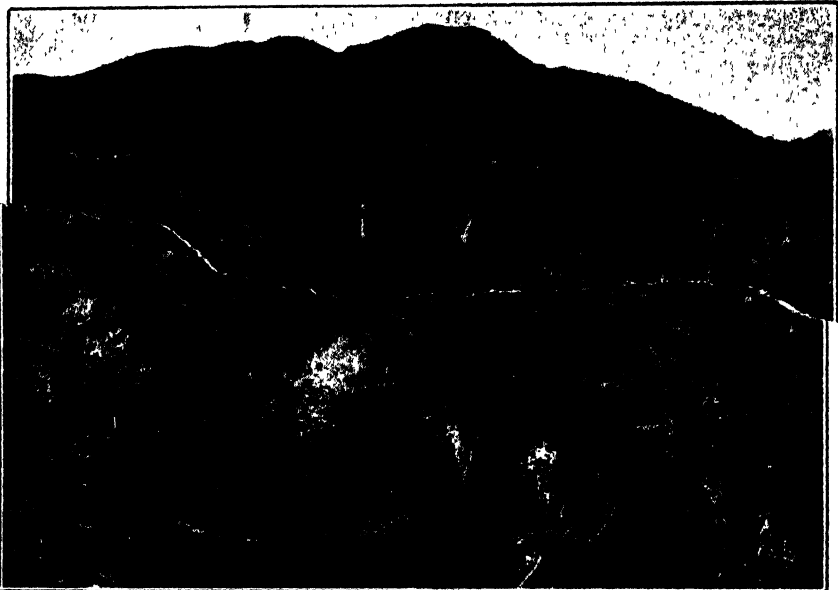


FIG. 9. FOREST MUCH DAMAGED AND MODIFIED, AWAITING RESTORATION

[Photo by H. Drake.]

planting can be begun without delay. Nor is such use of the one gully hostile to our motto, "Bring back the forest to its original composition and status, but change it not at all."

Summary.

In this article is told how Wilton's Bush, or the Otari Native-plant Museum, came into the hands of the Government, which constituted it a scenic reserve, and how, later, it was acquired by the Wellington City Council, partly by purchase. Further, it is explained how the purpose of the reserve was altered--largely through the action of the New Zealand Institute of Horticulture--and how it has been constituted an "open-air native-plant museum" where nothing is to be grown save the indigenous plants of the New Zealand region.

The plan upon which the museum is to be arranged—a plan approved by the City Council—is explained at some length. Briefly, it consists of a fourfold scheme, including (1) a collection of all the New Zealand species which can be grown; (2) examples, to be artificially made, of various important features of the primeval vegetation of New Zealand—this a unique undertaking; (3) the use of indigenous plants for horticultural purposes to be illustrated in various ways for the information of those desirous of using such plants in their gardens; and (4) the restoration of the present forest to what it was originally.

This plan in its entirety is the first to be formulated in any part of the world. It is full of possibilities for the good of the people. It is not for Wellington only but for the Dominion as a whole. Indeed, as the flora and vegetation of New Zealand are considered of special interest the world over, the influence of the Otari Open-air Native-plant Museum will be world-wide.

SELLING POULTRY BY WEIGHT.

F. C. BROWN, Chief Poultry Instructor, Wellington.

THE system of selling table cockerels by weight is now being freely adopted by many producers who cater for the Wellington market. At the present time poulterers and others interested in the table-poultry trade are giving 1s. 3d. per pound net for live birds scaling 3 lb. or over and in good marketable condition. Both buyers and sellers appear to welcome the change from the crude method of selling by the pair. Although this is the case, circumstances sometimes arise under the new system which bring about dissatisfaction. This is usually due to failure on the part of the producers to realize the unavoidable loss in weight which takes place during the transit of live birds from farm to market, especially when a lengthy railway journey is involved. On being dispatched from the farm the birds probably have their crop and intestines full, with the result that they do not weigh as well on arrival at the market or the purchaser's premises. Thus a good allowance must be made for the reduction.

An experiment designed to ascertain as closely as possible the loss in weight likely to take place with crated cockerels over a period of time was recently carried out at the Wallaceville Poultry Station. Sixty cockerels of the White Leghorn and Minorca breeds were used for the experiment. At 1 p.m. the birds were provided with their ordinary midday meal (mash), and at 2 p.m. they were placed in three market crates and weighed. They were again weighed at 9 a.m. on the following morning, and then dispatched to market. They reached the purchaser's premises at 4 p.m., or twenty-six hours after being first weighed, and were then again weighed.

The following table shows the results of the three weighings, and the loss of weight which took place during the first nineteen hours and twenty-six hours respectively after crating. It may be mentioned that while the experiment was being conducted climatic conditions were cool. Had the weather been warm there would

probably have been a greater reduction in weight. Further experiments on similar lines will be conducted at the Wallaceville Station in due course, in order to obtain wider data.

Crate No.	Number of Cockerels.	First Weighing.	Second Weighing.	Reduction in Weight.	Third Weighing.	Reduction in Weight.	Loss per Crate.
		lb.	lb.	lb.	lb.	lb.	lb.
1	20	102	97	5	95½	1½	6½
2	15	61	59	2	57	2	4
3	25	95	90	5	88	2	7

Aggregate loss, 17½ lb.

The most important point to note in connection with the present experiment was the average loss per bird of nearly 4½ oz. during twenty-six hours, or a total of 17½ lb. on the line of sixty, which in money value, at 1s. 3d. per pound, would represent £1 1s. 10½d. It will thus be seen how easily dissatisfaction may be brought about between buyer and seller.

Apart, however, from the loss of weight which takes place during transit, there are other matters that must be taken into account by the producer if selling by weight is to be as satisfactory to both parties as it should be. Reference is now made to the half-starved condition in which many producers send their cockerels to market. Such birds may scale more than the minimum weight of 3 lb. demanded, but if they are but mere frames they are not favoured by the high-class poulterer, to whom one properly fattened bird is worth more than two unfattened.

Another common mistake made by producers is to retain their cockerels till they have passed the prime chicken stage of, say, about five months old, and until they develop a sharp spur. Such birds are known to the trade as "stags," and are usually of little more value to the poulterer than an old hen.

Selling by weight should undoubtedly commend itself to the producer, as thereby he is not only encouraged to prime his birds to the best advantage, but is also in a better position to figure out the return he will receive. Any extension of the system in the Dominion will undoubtedly encourage the production of better table-poultry. The system, however, will never be placed on a really sound footing until the average producer realizes better than he does now the quality of stock demanded for the high-class trade.

The buyer as well as the producer has his part to fulfil. In the first place, he should see that all birds sent to him are carefully weighed and payment made accordingly. He should also see that there is no undue delay in collecting birds from railway-stations, &c., and having them weighed at the earliest possible moment, especially when consigned from a distance. A case in point recently came under my notice, when a line of cockerels forwarded to be sold by weight were not collected from the railway-station nor weighted for twenty-four hours after their arrival. Obviously a considerable reduction in weight took place, while, naturally, the returns did not come up to the owner's expectations.

SUBTROPICAL-FRUIT CULTURE.

ACHIEVEMENT AND POSSIBILITIES IN THE AUCKLAND DISTRICT.

Address by W. H. RICE, Orchard Instructor, at the Annual Conference of the New Zealand Association of Nurserymen, Auckland, January, 1927.

THE coastal regions of North Auckland, the Auckland Isthmus, and the East Coast of the Auckland Land District embrace a large area of land which is suitable for the cultivation of subtropical or semi-subtropical fruits. The range of subject in this paper is restricted to those species which will endure light frosts periodically, as it is exceptional to find a location that can be depended upon as permanently free from frost. In areas subject to regular frosts many of the more tender plants cannot be grown, so that the remainder of the Dominion is available as a home market for the produce.

In areas geographically situated as North Auckland frosts usually travel in south-western currents, which are deflected by hills and encouraged by large open spaces or continuous valleys. The gentle northerly slopes of a ridge will usually be found frost-free or most nearly so, except in such places where side deflections of air-currents are caused by foothills which divert the wind. However ideal the natural lay of the land, there are very few places which are not improved by growing a good south-westerly and easterly shelter-belt of sufficient density to prevent more than a gentle movement of air through the plantation. An easterly shelter is more necessary for the subtropical class of fruits than the harder temperate ones. Generally they are of a much softer luxuriant growth, easily damaged by the high winds which are frequently experienced from the east; and, further, some protection from the early sun is advisable in case of a light frost, so as to prolong thawing and thus minimize damage.

CITRUS-FRUIT.

The testing and establishment of subtropical fruits has been undertaken since the earlier settlement of the North, the citrus family having proved the most adaptable and profitable. Lemons and oranges were among the early exotics planted in this district, and history shows that they have succeeded or declined according to the amount of attention given to their culture. As introduced plants they have never been quite at home naturally, but they have responded to culture admirably. There are no fruit-trees grown here which decline so rapidly when care and attention are withheld, and this no doubt accounts for the fact that very few of the earlier plantations are in existence to-day. On the other hand, the response to proper culture is so good that the citrus industry has made rapid strides towards economic importance. Lemons in particular may be grown to near perfection.

Lemons.

Some twenty years ago Auckland-grown lemons were exhibited and highly praised in Australia, and this year, despite the large quantities of citrus fruits grown in the Commonwealth, New Zealand

lemons were exported there and realized approximately £1 per case—not individual cases, but consignments of several hundreds. Apart from export, the possibilities are here in the North for development to displace the heavy importation of fresh lemons, candied and pickled peel, essence and oil of lemon, citric acid, &c. ; and with fruit drinks growing in popularity there can be no doubt that our home markets are capable of absorbing larger quantities of locally-grown lemons. It is apparent, however, that a larger proportion of high-quality product is necessary to hold the local market against the imported lemons.

Probably the most serious drawback to profitable culture of lemons is the large amount of second-grade and cull fruit grown. As might be expected with an introduced plant under conditions varying from the natural habitat, decline is more likely to result naturally than a disposition to improvement. Therefore very keen attention and constant vigilance to select the best from which to propagate is required. New Zealand nurserymen are to be congratulated on having maintained the desirable types at so high a pitch, and it is pleasing to record that every year sees them more enthusiastic in the matter, so that practically the whole of the buds used for propagating this year are from trees specially selected by the Institute of Horticulture. This will do much towards ensuring a larger output of high quality, as with trees of selection the basis is right, without which the cultivation would be handicapped. This, of course, is not all that is required, constant care and a high degree of skill being also needed to bring the trees to profitable perfection ; but it is the nurserymen's part to lay the foundation in a manner that will reflect credit on the industry to which he belongs and profit to the Dominion.

The varieties of citrus-fruits suitable for commercial planting are somewhat restricted, and attention should be confined to those of approved merit. New varieties are constantly being introduced and tried out, but it would certainly not be wise to plant on a large scale varieties other than those which have proved their worth. Of the lemons, Lisbon is favourite with us ; it is a very adaptable tree to a wide range of soil conditions and of good robust constitution and heavy fruiting habit. Eureka is now grown approximately to the same extent as Lisbon, and gives equally good returns of somewhat better-shaped fruit. Eureka is a thornless tree, and preferred by some for this reason. A good planting is equal numbers of Lisbon and Eureka, which affords an almost continuous supply of fruits. Villa Franca, Messina, and Sicily are varieties which have been under observation for some years, but have not disclosed any special merit to justify them being planted in preference to Lisbon and Eureka. Genoa and Meyer are of comparative recent introduction, and are worthy of trial in a limited way.

Oranges.

Of the preserving oranges, the well-known Poorman retains its place as the most suitable. Seville is now little grown here, being considered too bitter, and Kin Kan—which was introduced a few years ago—is proving too coarse in texture and far too seedy to be readily acceptable.

There is a decided leaning in this country towards the use of the Poorman orange as a breakfast grapefruit, the larger sizes being particularly suitable for this purpose. The true grapefruits, Marsh's Seedless and Foster, are both being grown here, but there is no indication that they are worthy of cultivation for profit. The Poorman orange is really a kind of pomelo, and its larger fruits will meet with keener demand as time goes on and the use of breakfast fruit becomes more general in New Zealand. It is, therefore, a dual-purpose orange—preserving and dessert.

Though sweet oranges grow well in most parts of our citrus areas, they do not thrive with sufficient luxuriance to economically compete with the produce of the Pacific islands and parts of Australia. Until, therefore, a variety is introduced which will succeed considerably better than any now grown, it would not be wise to undertake sweet-orange growing as a commercial proposition. Nevertheless, they can be grown quite well for domestic purposes, and there are instances of late fruits being profitably marketed after the Island season is finished. The most satisfactory variety to plant is Valencia Late, as it hangs for a longer period on the tree to mature, and at the same time retains its juice. Navelencia is the next to be preferred, while Best's Seedless, a variety of local raising, does quite well when the trees get older, but does not come into bearing nearly as early as Valencia or Navelencia. St. Michael, Jaffa, and Mediterranean Sweet are also grown locally, but are usually of smaller size and variable in quality.

Like the sweet orange, the mandarin is hardly worthy of extensive cultivation here for commerce, but where a few trees are to be grown Emperor, Thorny, and Scarlet will give good results. A wide range of the citrus family may be grown as ornamental if not profitable plants, and add charm to Northern gardens.

THE LOQUAT.

Another subject worthy of more attention is the loquat. This highly ornamental species (*Eriobotrya japonica*) luxuriates in the North, but it is perhaps the most disappointing fruiting tree grown, undoubtedly owing to its indiscriminate propagation from seeds. The trees most frequently seen are haphazard fruiters, not even maintaining a biennial or triennial fruiting habit. This has given a false reputation to a desirable fruit, and at present the loquat is grown more as an ornamental and shelter tree from which fruit is occasionally picked. There are, however, available from nurserymen worked trees of superior quality, varieties which, although quite as ornamental and suitable for shelter trees, have more constancy of fruiting and better quality. The fact that the period for marketing loquats is when other fruits are scarce invariably means good prices, and when one considers that mainly Australian-grown fruit is sold retail here, and compares the freedom of growth in this country, one can only assume that better and more constant fruiting varieties would make loquat-growing a profitable side-line from shelter-trees, or even as a section of a commercial orchard.

THE GUAVA.

Plants established throughout the Auckland District show that two species of guava are of wide distribution, these being *Psidium Cattleianum* and *Psidium Guyava*—the purple and yellow varieties respectively. Of the older plants which are succeeding, the purple predominates and is undoubtedly the hardier. There are a very few aged plants of the yellow variety, though it is quite common in nurseries. As domestic plants both are useful, fruiting as they do in the off-season, and meeting a wide range of uses—preserves, jellies, cooking, and dessert. As a commercial proposition, however, the yellow does not promise as well as the purple. Undoubtedly the yellow kind is larger and of better dessert quality, but this is a fact also known to the birds, who greedily devour most of the yellow fruit grown. The yellow variety is also disposed to shed its fruit when half-matured.

A very pronounced feature of the older fruiting trees is the wide range of strains grown. Occasionally a plant is found producing superior-sized fruits with a refined seed, while others—under the same conditions—are not worth cultivation as fruiting plants, though highly ornamental. It should be the duty of every propagator to select from the best type only, in order that evolution of this species may be assisted, or to adopt vegetative reproduction so as to avoid the wide range to be expected from seedlings.

Though there is a very limited area planted in guavas in a methodical orchard way, there is sufficient to indicate that this is not the most economical way to grow the plant. The most profit from a minimum area of land is returned when these plants are used as a dividing hedge. They thrive best in close company, crop quite well, and provide a very desirable hedgerow, but should not be expected to act as a breakwind to south or south-west winds.

Further introduction of allied species might be profitably done, particularly from Norfolk Island, where, I understand, the species common to New Zealand has quite superior variations.

FEIJOA.

A warm-climate fruit of recent introduction, which will no doubt become quite popular, is *Feijoa sellowiana*, of the myrtle family, a highly ornamental shrub with mid-green foliage, silver on the reverse side. It has a very symmetrical growth which carries a profusion of quaint flowers—purple, white, and blue in pleasing combination, the petals are thick, fleshy, and sweetly flavoured. The highly perfumed late autumn fruit, about the size of a walnut, is of a sweet pineapple-strawberry flavour, but lacks acid. Mr. Hayward Wright, of Avondale, has some fine specimens of feijoa which have demonstrated its suitability to the Auckland climate. As an ornamental plant it is to be highly recommended, while the fruit is a decided acquisition.

PASSION-FRUIT.

Passion-fruits are most accommodating plants to the varying conditions of the North. Of this branch of the *Granadilla* family *Passiflora edulis* succeeds to best advantage for commercial purposes. Though the long white variety does quite well it is most suitable for

domestic purposes near the point where it is grown, owing to the softer nature of the rind. Of the purple passion-fruit the Mammoth variety is certainly more attractive, owing to size, but this is the only advantage it possesses over the smaller variety. The ordinary small *edulis* can be depended upon to set a prolific crop sufficient to compensate for the lack of size, so that the output per acre is equal. The Mammoth is prone to partial infertility, and produces many semi-hollow fruits, a fault rarely met with in the smaller variety. Fullness of pulp is a great commercial asset, as consumers soon become dissatisfied with sham fruits and restrict purchases. Rapidity to wilt and become corrugated after picking is also more pronounced in the Mammoth than in the smaller variety.

The case of cultivation, which is only marred by certain obscure troubles of establishment after transplanting, is such that it is surprising that a greater extension is not made. Though a plantation is more of a temporary nature than most vine or tree fruits the time between planting and fruiting is less, and returns are thus secured much earlier, an advantage with new settlers and others desiring a semi-temporary catch-crop between wide-spaced orchard trees. The local markets are capable of absorbing at payable prices considerably more passion-fruit than is at present grown, while the overseas market is as yet only touched. Australia is planting extensively for export to Europe as fresh fruit and pulp, so that quantities should soon be going forward sufficient to make an impression. Therefore, with only high-quality fruit exported from this Dominion, we can confidently look forward to the best returns from Europe. High quality only is mentioned advisably, as it is only that quality which will pay. The production of a large proportion of low-grade fruit would seriously affect the profits of a plantation.

The passion is more accommodating than most fruit, inasmuch as fruits of inferior size and appearance may be used for pulp. On the other hand, the ease of propagation is such that strains of low quality are more apt to be perpetuated, for to a large extent the propagation is not in the hands of highly skilled propagators, but undertaken by all and sundry. Every effort should be continued by nurserymen to select seeds of advanced quality and prolonged fruiting habit, and to produce plants which will become known as superior to home-raised; it is only by such selection that the general average of quality can be maintained or raised. There is also room for a considerable amount of research work with the object of determining other varieties of the *Granadilla* family suitable to conditions here. It is well within the bounds of horticultural possibility that a hybrid could be raised which might exceed all others in quality and become of considerable commercial value to the Dominion.

TREE TOMATO.

Cyphomandia betacea is most luxuriant in growth and prolific in fruiting in localities free from wind and frost. Quite profitable crops are grown on plants three years from seed, and though the plants are more or less of a temporary nature—say, ten years—the produce is absorbed locally at prices which make growing profitable. The plants will withstand only slight frosts, and their culture is impossible in

other places. High winds are very detrimental, and may make an otherwise suitable locality impracticable for tree-tomato culture. Too close or dense a shelter creates conditions suitable to mildew, practically the only disease which affects these plants, so a naturally wind-free situation is to be desired.

It is generally conceded that consumers have to acquire a liking for the peculiar flavour of the tree-tomato before partaking freely of the fruit ; nevertheless, the demand is quite keen for dessert purposes, while the fruit is eagerly sought after for preserving. The suitability of tree-tomatoes as a pie fruit requires only to be better known to be more appreciated, available as they are in the season of shortage of soft pie-fruits. Possibly the greatest improvement on existing varieties could be made in the direction of extending the season, as the very late and slightly out-of-season fruits command luxury prices at present.

THE AVOCADO.

An example of a fruiting plant attaining great commercial value in a short space of time is the development of *Persea gratissima* on the American Continent. Two races, natives of the West Indies and Guatamala, have been used to evolve the modern commercial variety, which has been extensively planted in Florida and California and is meeting with a keen demand in the United States generally.

The avocado is a handsome evergreen tree, mature at from 25 ft. to 30 ft. The fruits are pear-shaped, about the size of a large pear, and contain a large single seed. When ripe the skin parts easily from the pulp, which is of firm though buttery consistency, and with pepper and salt makes a perfect salad in itself. Few people fail to like it even at first trial. The fruit is highly charged with a nutritious oil, which is quite agreeable to the palate. Plants have been established here for some years and do quite well in frost-free areas. Mr. J. H. Davidson, of Tauranga, has fruited some trees, and has a range of varieties under trial, by arrangement with the Department of Agriculture, while many other plants are distributed throughout the North. Many nurserymen are now offering plants propagated in the most approved manner for avoiding any risk of seedling variations, and it will be highly interesting and probably profitable to foster the establishment of the correct variety in the more subtropical parts of the Dominion. It is hardly to be expected that we shall produce such luxuriant fruits as in the tropics, but owing to the susceptibility of the avocado to fruit-fly it is not likely that this market will ever be supplied from outside countries, and the hardier varieties may succeed here quite well enough to give the people the benefit of this highly nutritious and agreeable dessert fruit.

OTHER VARIETIES.

Other subtropical fruits known to grow well but not fruit luxuriantly in the Auckland District include the following : *Casimiroa edulis*, the white sapota of Vera Cruz ; *Zissiphus*, the true jujube ; and *Punica granatum*, the pomegranate of commerce. There are also enormous latent possibilities in the adoption of fig-culture, providing the right varieties are introduced or raised.

TOP-DRESSING EXPERIMENTS ON PASTURE IN OTAGO.

PRELIMINARY TRIALS, SEASON 1926-27.

R. B. TENNENT, N.D.D., Instructor in Agriculture, Dunedin.

THREE co-operative top-dressing experiments, laid out in such a way that the results could be statistically examined, were conducted in the South Otago district during the past season. These experiments were intended to serve as a forerunner to a comprehensive programme of grassland experimentation, embracing the whole of Otago, which has been arranged for the coming season of 1927-28. A mass of general information, based largely upon observation only, has been obtained during past years as to the result of various top-dressings, but so conflicting were the impressions gained that it was decided to ascertain if possible by a series of well-conducted experiments the relative merits of certain fertilizers when applied to varying types of pastures under different soil and climatic conditions.

The common, and apparently unavoidable, practice of breaking up every four or five years what were originally intended to be permanent pastures, and then resowing them again, has been in vogue to a great extent in the South, involving the farmer in an ever-recurring expenditure every few years of anything from £3 to £6 per acre. The experiments now in hand are intended to ascertain whether the life of the pasture cannot be considerably lengthened and maintained in a high state of palatability with a comparatively small expenditure by the application at periodical intervals of moderate quantities of manures.

Much is heard in the South of the effect of lime, alone or in conjunction with phosphates, in invigorating the growth of grass, and lime has accordingly been incorporated with this series of experiments to determine its effect. The residual effect of the various fertilizers is of undoubted value, and an effort will be made to ascertain the number of years over which such effects will be felt.

The Past Season's Trials.

Two experimental plots were laid down in the Crookston district and one at Awamangu. The fertilizers used were 44-46 per cent. superphosphate, basic slag (Anchor brand), and ground carbonate of lime (CaCO_3). The three experiments were laid out in an exactly similar manner, the drill strip method, which has previously been described in this *Journal*, being utilized. Sufficient replications of strips were made to reduce to a minimum any soil-variations which might exist. The plots were established with the objects of carrying them on for at least four years. The following briefly summarizes the experiments:—

(1) FARM OF T. REVIE, CROOKSTON.

For the purpose of this experiment an old pasture was selected on land which might be described as good heavy agricultural land. The pasture could not be called a good one, having run largely to brown-top, crested dogtail, and Yorkshire fog, but it also contained a fair

proportion of perennial rye-grass, cocksfoot, and white clover. The pasture had obviously started to run to inferior grasses, and appeared to be one typical upon which to experiment. The quantities per acre of fertilizers and lime used were as follows: Basic slag, $2\frac{1}{2}$ cwt.; superphosphate, $2\frac{1}{2}$ cwt.; carbonate of lime, 1 ton. Top-dressing was carried out on 17th August, 1926; the plot was closed to stock on 29th October; and harvesting took place on 19th January, 1927, a period of nearly thirteen weeks after closing. The following table gives a summary of the results obtained:—

Table 1.

Treatment.	Average Green Weight of Plot.	Probable Error.	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
	lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
Basic slag and lime	50.6	± 1.41	1 8 1	7 1 3	1 9 7 $\frac{1}{2}$	Loss 1 10 10 $\frac{1}{2}$
Basic slag ..	54.7	± 1.55	1 10 3	7 13 7	0 15 7 $\frac{1}{2}$	Loss 0 4 6 $\frac{1}{2}$
Super and lime ..	64.3	± 0.94	1 16 0	9 0 0	1 9 3 $\frac{1}{2}$	Gain 0 8 2 $\frac{1}{2}$
Super ..	64.4	± 1.28	1 16 1	9 1 3	0 15 3 $\frac{1}{2}$	Gain 1 3 5 $\frac{1}{2}$
Lime ..	49.6	± 1.28	1 7 3	6 19 8 $\frac{1}{2}$	0 14 0	Loss 0 16 9 $\frac{1}{2}$
Control..	50.9	± 1.68	1 8 2	7 2 6	..	..

In the case of this experiment the plot could have been shut up earlier—say, about 1st October—so as to give greater growth for weighing. As will be observed, superphosphate on this season's results gave the greatest increase of hay per acre over the control—namely, 7 cwt. 3 qr. per acre. Basic slag gave an increase of 2 cwt. 1 qr. per acre. Lime showed no increase whatever, nor was its effect shown in combination with either superphosphate or basic slag.

(2) FARM OF W. H. LUSK, CROOKSTON.

The pasture selected for this experiment had deteriorated very much, and looked most unpromising in so far as any attempt at rejuvenation was concerned. Brown-top, fog, and crested dogstail predominated, although vestiges of cocksfoot, perennial rye-grass, and more particularly white clover remained. The soil conditions were similar to those obtaining on Mr. Revie's plot. The quantities of fertilizers applied were as follows: Basic slag, $2\frac{1}{2}$ cwt.; superphosphate, $2\frac{1}{2}$ cwt.; carbonate of lime, 1 ton, per acre. The plot was top-dressed on 18th August, 1926, shut up on 2nd December, and mown on 20th January, 1927, having been closed for a period of seven weeks. Table 2 summarizes the results obtained.

This plot, unfortunately, was closed for only seven weeks, and the resultant poor growth was insufficient to give marked increases. However, as could be expected, the results closely paralleled those obtained on Mr. Revie's plot, in that superphosphate showed the greatest gain over control—3 cwt. 3 qr. per acre—whereas neither basic slag nor lime showed any increase, nor was the effect of lime shown in combination with either superphosphate or basic slag.

Table 2.

Treatment.	Average Green Weight of Plot.	Probable Error.	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
	lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
Basic slag and lime	38.1	±1.75	1 1 2	5 7 6	1 9 7½	Loss 1 15 10½
Basic slag ..	40.5	±2.61	1 2 3	5 13 9	0 15 7½	Loss 0 15 7½
Super and lime ..	46.5	±1.54	1 6 1	6 11 3	1 9 3¾	Loss 0 11 9
Super ..	46.8	±2.47	1 6 2	6 12 6	0 15 3¾	Gain 0 2 5¼
Lime ..	38.4	±1.47	1 1 3	5 8 9	0 14 0	Loss 0 19 0
Control ..	40.5	±2.08	1 2 3	5 13 9	..	..

(3) FARM OF D. SMOLLET, AWAMANGU.

For this experiment a young pasture two years old, consisting largely of perennial rye-grass, cocksfoot, red clover, and white clover, was utilized. It was situated on good hill-country, and was selected largely on account of the short-lived nature of pastures of this type in the Awamangu district. In this case heavier dressings of fertilizers were used than with the other experiments, the amounts being as follows: Basic slag, 5½ cwt.; superphosphate, 3¼ cwt.; and carbonate of lime, 1 ton, per acre. The top-dressing was done on 19th August, 1926; the plot was closed to stock on 18th October, and harvested on 25th January, 1927, a period of fourteen weeks. The following table summarizes the results:—

Table 3

Treatment.	Average Green Weight of Plot.	Probable Error.	Estimated Weight of Hay per Acre.	Value of Hay per Acre.	Cost of Manure per Acre.	Profit or Loss compared with Unmanured Plot.
	lb.		T. cwt. qr.	£ s. d.	£ s. d.	£ s. d.
Basic slag and lime	92.1	±2.42	2 12 0	13 0 0	2 7 0	Gain 2 3 0
Basic slag ..	91.1	±1.41	2 11 1	12 16 1	1 13 0	Gain 2 13 1
Super and lime ..	64.7	±2.36	1 16 2	9 12 6	1 16 6	Loss 0 14 0
Super ..	62.5	±1.68	1 15 0	8 15 0	1 2 6	Loss 0 17 6
Lime ..	64.3	±1.88	1 16 0	9 0 0	0 14 0	Gain 0 4 0
Control ..	60.7	±1.75	1 14 0	8 10 0	..	..

The results obtained from this experiment are most interesting, and quite the reverse to those obtained in the Crookston district. It will be seen from the table that basic slag and lime gave the greatest gain over the control plot—namely, 18 cwt. per acre. Basic slag alone gave an increase of 17 cwt. 1 qr. per acre; superphosphate and lime a gain of only 2 cwt. 2 qr.; and super alone a gain of 1 cwt. Lime in this case gave a gain of 2 cwt. per acre.

GENERAL SUMMARY OF RESULTS.

(1) It is to be borne in mind that the results obtained from the various fertilizers cannot be correctly evaluated until the expiry of at least four years. It is intended to carry out the experiments for that length of time.



FIG. 1. BASIC SLAG PLOT ON MR. SMOLLET'S FARM, AWAMANGU, SHOWING PROFUSION OF RED CLOVER.

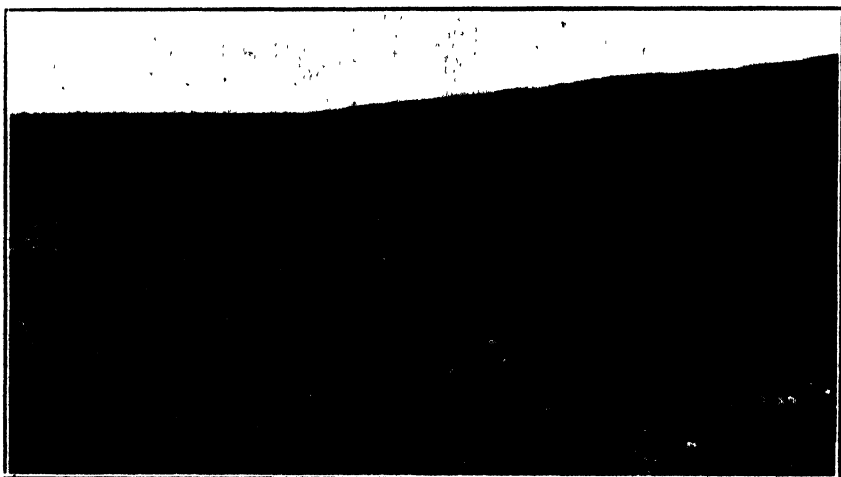


FIG. 2. SUPERPHOSPHATE PLOT IN SAME TRIAL ON MR. SMOLLET'S FARM.

(2) The whole cost of the various fertilizers has been charged against the value of the hay taken off the plots during the short period of time during which they were closed to stock. This is not fair to this year's hay crops, for undoubtedly the effect of the fertilizers will be felt over a number of years.

(3) The gauge utilized in recording the effect of the fertilizers was the increase in weights of hay obtained. No credit so far has been accorded to the respective increase in nutritive value of herbage between controls and top-dressed plots.

(4) At Crookston, contrary to general expectations, carbonate of lime showed no increase over the control plots, despite the fact that a wet season was experienced, while in the Awamangu district lime showed a slight increase.

(5) At Crookston superphosphate proved, on this year's results, the best fertilizer to use on old pasture.

(6) At Awamangu basic slag was pre-eminently superior to superphosphate on a comparatively young pasture.

Thanks are due to Messrs. Revie, Lusk, and Smollet for their unflinching interest and co-operation in connection with the trials. Acknowledgment is also made of the assistance given in the conduct of the experiments by Messrs. Duff and Hume, of the Fields Division.

THE PRUNING OF ORCHARD TREES.

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PRUNING is one of the most important of the many operations to which the commercial orchardist has to give his attention. It is an operation which calls for the highest degree of skill, for on the manner in which the work is carried out largely depends the following and subsequent seasons' crops. The various varieties of the different kinds of fruits call for different treatment; the trees of the same variety in different localities, and in the same orchard, require individual attention and treatment.

The primary object of pruning is to obtain a greater quantity of high-grade fruit; secondly, the young tree is pruned to a desired shape; thirdly, pruning is practised to renovate trees for the purpose of returning them to profit and to a suitable shape. To become a successful pruner an elementary knowledge of how plants grow is essential. The lack of this special knowledge has been the cause of keen disappointment to many an amateur pruner. For the different kinds of fruit-trees there are various systems and ideals of pruning. It is important for the pruner to have a clear mental picture of the ideal he is striving for; he must clearly understand the objects and principles of pruning.

It is also necessary for the orchardist to realize that no matter how skilfully pruning is done to develop trees of normal stature and capable of producing large crops of high-grade fruit, he must not expect to secure satisfactory results unless the soil is in such good condition as to furnish sufficient food and moisture when required, in order to ensure the development of good strong fruit-buds. Pruning is not a cure for all the ills that a tree is subject to. The fruitgrower must realize and appreciate the importance of such orchard operations as cultivation, drainage, and maintenance of soil-fertility.

BUILDING UP THE FRAMEWORK.

For success in training the young tree the pruner before he begins must have a clear mental picture of the mature tree. One of the greatest necessities of a good tree is a substantial framework. The

rod should be cut at a height of not more than 20 in. from the ground-line. Experience has shown that trees headed back to this height are the easiest to care for, and that they are the most economical for pruning, spraying, thinning of the fruit, and harvesting of the crop. The trunk and limbs are more shaded from the sun on a low-headed tree. A spiral of three or four buds equidistantly spaced around the rod should be selected. The farther apart they are from one another the stronger and better will be the framework. A stub of good length should be left above the topmost bud of the spiral so as to throw the topmost branch out, in order to give a broad base to the tree; this stub is to be removed the following season. Every endeavour should be made to avoid sharp-angled crotches.

At the next pruning three or four main branches equidistantly spaced round the trunk should be selected. These branches should be cut back, according to their strength, from 8 in. to 10 in., the strongest branches the most severely and the weakest the least. Thus the leaf area of the stronger branches will be reduced and the leaf area of the weaker increased, and this will give a balance and cause weak branches to gain their proper strength. This cutting-back tends to make the limbs more stocky. At the following winter pruning select from six to eight conveniently placed strong branches, which should be cut back, leaving 12 in. or 14 in. A few of the short twiggy growths which have developed on the main arms may be left uncut.

At the following season's pruning select ten to sixteen suitable branches as leaders, which should be cut reasonably long so as to avoid forcing the tree into excessive and heavy wood-growth. As regards apple-trees, lateral growths which are being retained should be left not less than 8 in. long in the case of Sturmers, 12 in. in Jonathans, and 14 in. on strong-growing varieties such as Delicious.

DEVELOPMENT OF FRUITING-WOOD.

When treating the laterals many growers make the mistake of thinning these out too much and cutting them back far too severely. They should be thinned in such a manner as to distribute them evenly over all parts of the tree. Should too many be left they may be removed or shortened back after the tree comes into bearing. The trees having passed through the period of framework-building should now have good trunks, limbs, and branches, and should be approaching the period when they will commence bearing good crops.

In addition to good crops, uniformity, reasonable size, high colour, &c., are desired with all our fruits, and to obtain and maintain these a light annual pruning is required. It is generally recognized that thinning is necessary on heavily bearing trees for production of fruits of the characteristics just mentioned, and this may be conveniently done at the time of pruning. By thinning out the fruit-buds and fruit-spurs those remaining should be invigorated and yield a better class of fruit. The amount of fruiting-wood to be left on the trees at this stage of their existence is a matter which the orchardist must decide for himself, ever bearing in mind that the good growth of his trees is a first consideration. The pruner should attempt to develop a reasonable amount of new wood annually, in order to provide for

the necessary increase of new buds and spurs, which are essential if the trees are to remain productive over a period of years.

It should be kept in mind that pruning is done first with the object of building up a strong symmetrical framework, and then of developing the maximum amount of fruit-bearing wood possible. Do not allow the tree to overbear. Maintain the soil in good condition, and keep it supplied with such plant-food as will cause the trees to thrive. Keep the centre of the tree reasonably open. No one leader should be allowed to take the lead ; all should be kept as evenly balanced for strength and position as possible. Make all cuts carefully. Keep under control diseases which affect the trees.

There are many trees of such weakly and stunted condition that it is difficult to decide which is the proper method of treatment to obtain the desired results. Growers who do not thoroughly understand the practices of pruning or their application to particular trees in the orchard should seek the assistance of the district Orchard Instructor.

STONE-FRUITS.

Peach and Nectarine.

The peach and nectarine may be taken together, as their fruit-bearing habits of growth are very similar. The fruit is produced on the past season's wood, and occasionally varieties will be found bearing fruit on short spurs. The fruiting-buds of some varieties are situated nearer the terminal of the laterals than is the case in other varieties. The bearing habit of the variety will, however, dictate the method of pruning to be adopted. The trees require to be kept growing vigorously by cultivation, manuring, spraying, and pruning, in order that they may produce a sufficient annual lateral growth of from 18 in. to 20 in. long and so that they may be kept well furnished with bearing-wood. The new growth only bears fruit in the season following its production and then becomes barren. If left unpruned each season, as the new growths extend they become shorter and ultimately unfruitful. Those situated on the lower portions of limbs frequently die. A peach or nectarine tree will soon run itself out if new growth is not maintained.

Being possessed of this knowledge, the operator must prune in such a manner as to maintain an even distribution of strong lateral growth over the whole surface of the tree. The system recommended for the treatment of bearing trees is to keep the leaders well spaced, and in normal vigorous trees cut back just hard enough to induce a sufficient development of lateral growth throughout the tree, at the same time avoiding too thick a growth in its head. The wood to be retained for fruit-bearing purposes should be carefully chosen from the shorter, well-matured laterals, and should be spaced as evenly as possible over the whole tree. Cut away the very strong-growing laterals. The medium to strong well-ripened laterals are the best for fruiting purposes. When cutting out laterals do not cut them so close to the collar as to damage the dormant buds at the base of the shoot.

With the knowledge that the fruit will be borne on the one-year-old wood the pruner must decide whether the laterals shall be reduced in length or left uncut. On this point opinions differ. Some growers are in the habit of shortening these laterals back ; experience, however,

has shown that they give better results if left uncut. It very frequently happens that when laterals are shortened the stronger and better buds are cut away and the weaker ones left, and these latter often drop off about blossoming-time. When laterals of this kind are left full length they will invariably break into growth towards the base, as well as making terminal growth. The laterals which fruited last season should be cut back at the base or back to the lower new wood which has developed on them. The new wood that is retained will carry the crop in the following season.

It is good practice to cut away at pruning all lateral growth which has fruited, and retain only the new lateral growths. In this way well-cared-for trees will always produce sufficient fruiting-wood. With light pruning heavy crops can be secured for a few seasons, and then the trees will ultimately run out. It is essential that the pruning be hard enough to induce a plentiful supply of new growth, so as to maintain good crops. In all cases where the trees are carrying an overload of fruit the fruit should be thinned early in December. Immediately after the fruit has set, laterals which are not carrying fruit should be cut back to the collar or to a developed bud near the base, in order to force new lateral growth from near the base of the shoot.

Apricot.

The apricot crops both on the previous season's laterals and on spurs. With most varieties the tendency is for the spurs to die out after two or three seasons, commencing from the base of the laterals; consequently, if left unpruned, laterals in time only produce fruit toward their tips. This may be avoided by following a system of renewal similar to that described for the peach. In normal growth the apricot produces less new wood than the peach, so that the pruning will mainly consist of cutting back the leaders, and thinning out and cutting back the laterals just sufficiently to keep up a sufficient supply of short healthy fruiting-wood and spurs. If extensions or replacements are necessary the stronger of the season's shoots, where growing in suitable positions, may be used to add to the fruit-bearing surface of the trees.

Most varieties of apricot spur freely, and the laterals produced may be cut hard back. An exception is the Roxburgh Red; the laterals of this variety which are retained for fruiting should not be shortened back.

Plum.

The plum requires different pruning from the peach. The habit of growth and fruiting of the European and Japanese varieties is different. The European varieties bear their fruit on spurs that are developed on wood two years old or older, while the Japanese varieties bear their fruits on wood developed during the past season and on spurs on older wood. European varieties rarely fruit on one-year-old wood, and are longer in coming into bearing than the Japanese type. An endeavour should be made to get as large a framework as possible during the early years of the tree. When the period of fruit-bearing arrives the pruning should consist of only a thinning-out of misplaced branches and laterals. Where necessary a shortening-back of the longer laterals can be made. Generally speaking, the greater number and best of the

fruits are borne on two- and three-year-old spurs on fairly strong lateral wood. Fruit is also borne on older spurs, but it is not, generally speaking, of such fine quality as that produced on the younger spurs. After four or five years fruiting the spurs become barren and die. To obtain regular fruiting and good crops it is necessary that a moderate supply of new lateral wood, with which to replace the older and worn-out parts, be produced each year.

The Japanese plum will bear fruit on one-year-old wood as well as on spurs on the older wood. The best fruits are generally borne towards the base of the one-year-old wood. The pruner should not overlook this point, for as a rule Japanese plums are prolific bearers, and small plums of this type do not pay for the harvesting and marketing. The operator must prune for large fruits, and to obtain this object good strong annual growth should be encouraged and the weaker growths and spurs thinned out. On account of the spreading and struggling habit of the Japanese plum it is difficult to secure a nice, well-balanced tree.

Cherry.

The cherry-tree that is thriving and has a well-formed strong framework requires little pruning. Every endeavour should be made in the training of the tree, by careful cutting-back of the leaders, to develop a low-spreading head similar to that of an apple-tree. The cutting-back beyond one-year-old shoots to promote branching is not recommended, because it frequently happens that where the leader is cut back into two- or three-year-old wood new side branches do not develop. In circumstances where trees lack the necessary vigour even cutting into one-year-old wood fails to produce the desired result. Cherry-trees should be kept growing moderately strongly and not allowed to become stunted.

The bearing habit, apart from the spurs developed on the leader growth, is always towards the ends of the shoots. The fruiting-wood should be well distributed on the limbs. In pruning to produce fruiting-wood care must be exercised not to overprune and force strong growths, as these are usually not as fruitful as the shorter laterals. Branches requiring cutting should be cut back only to a shoot or strong spur.

If left unpruned the cherry spurs will deteriorate after bearing regularly for a number of years, and will produce small inferior fruit singly instead of in clusters, and finally die.

NOTE.—The pruning of pip-fruit trees will be dealt with next month—concluding this article.

Quality in Butter and Cheese.—In the course of a recent address to dairy-factory managers, Mr. W. E. Gwillim, Assistant Director of the Dairy Division, remarked: "The improvement in the quality of our produce this season provides good reasons for congratulation. The great advance in the quality of cheese is particularly gratifying. It evidences good work on the part of milk-suppliers and of cheesemakers. It is generally agreed that about one-half the credit for the quality of cheese and butter is due to the supplier. Of the 100 grading-points available, 50 are obtainable for flavour, and the chance to get the right flavour rests primarily with the supplier. The most a cheesemaker or a buttermaker can do is to show the flavour in the most favourable light. The other obtainable points are principally for workmanship. As a minimum of 28½ points is required for body and texture in cheese to secure 'finest grade,' it is apparent that plenty of good workmanship has been put into cheesemaking this season."

DESTRUCTION OF TALL COUCH.

EXTENDED EXPERIMENT IN MARLBOROUGH.

F. W. GREENWOOD, B.A., Instructor in Agriculture, Blenheim.

IN the *Journal* for February, 1926, there appeared a short account of an experiment in the destruction of tall couch (*Agropyron repens*). Since making that report the writer has received so many inquiries from various parts of the Dominion as to the subsequent history of the paddock from which the seed crop of tares was taken that it seems advisable to publish some later particulars and photos for general information.

It may be recalled that on Mr. R. F. Goulter's farm, near Blenheim, a 40-acre block badly infested with couch was selected for experiment. In March, 1924, after the preliminary cultivation previously described had been carried out, Algerian oats and Scotch tares were sown at the rate of 2 bushels of oats and 1 bushel of tares per acre. During the succeeding winter this crop was grazed off-and-on with 400 ewes, a grass paddock adjacent to the oat and tare field being employed as a run-off. In the following spring grazing was continued on 22 acres of the oat and tare crop. At the end of February, 1925, every lamb was sent away fat. The 22 acres grazed ran back badly to couch. Of the other 18-acre paddock, 12 acres was cut for hay early in November, 1924, while the remaining 6 acres was carried on as a tare seed crop, the yield being 33 bushels per acre, and the price realized 8s. per bushel. As previously pointed out, the success of the seed tare crop as a smother was excellent, while the portion from which the hay was cut was also very much cleaner than the grazed area.

The subsequent history of these paddocks is briefly as follows: From autumn, 1925, to autumn, 1926, no crop was sown either in the 22-acre or in the 18-acre paddock; the 22-acre paddock containing couch was, however, lightly grazed with sheep from time to time. In the early autumn of 1926 the 18-acre paddock was sown with 2 bushels of Algerian oats and 1½ bushels of Scotch tares per acre. The mixed crop was harvested this autumn (1927), the yield being 20 bushels of tares plus 36 bushels of oats per acre—quite a profitable yield. The paddock has been ploughed and worked up again this autumn, and a sowing made at the rate of 2 bushels of tares and 1 bushel of Algerian oats per acre. Similarly the 22-acre paddock infested with couch, which was previously stocked, has been worked and similarly sown with oats and tares.

The accompanying photos, taken on 31st March last, illustrate the state of the paddocks. It will be noted from Fig. 1 that in the case of the 18-acre area, which has grown the seed tare smother-crop twice in succession, the ground is extremely clean, the only plants observable after cultivation being self-sown oats and tares. The photo (Fig. 2) of the 22-acre paddock, which was sown with oats and tares in the autumn of 1924 and fed off, but neither hayed nor seeded, shows distinctly that after three years tall couch is still much in evidence.

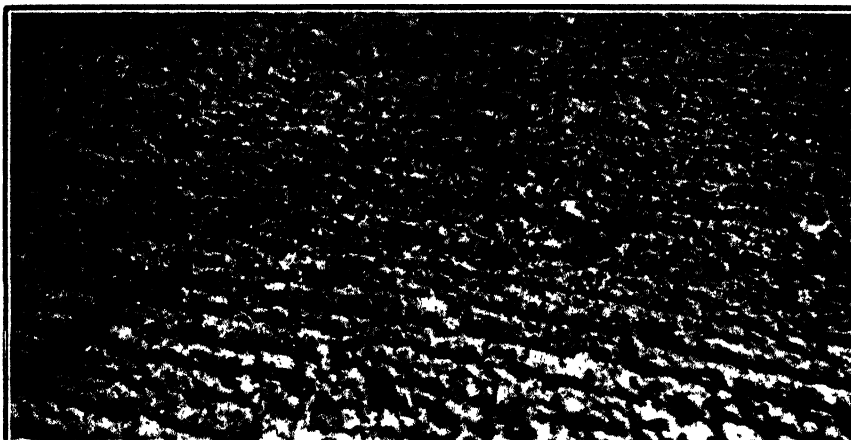


FIG. 1. GROUND IN 18-ACRE Paddock FREE OF TALL COUCH, AS SEEN THIS AUTUMN
The only plants showing are self-sown oats and tares from the last crop.

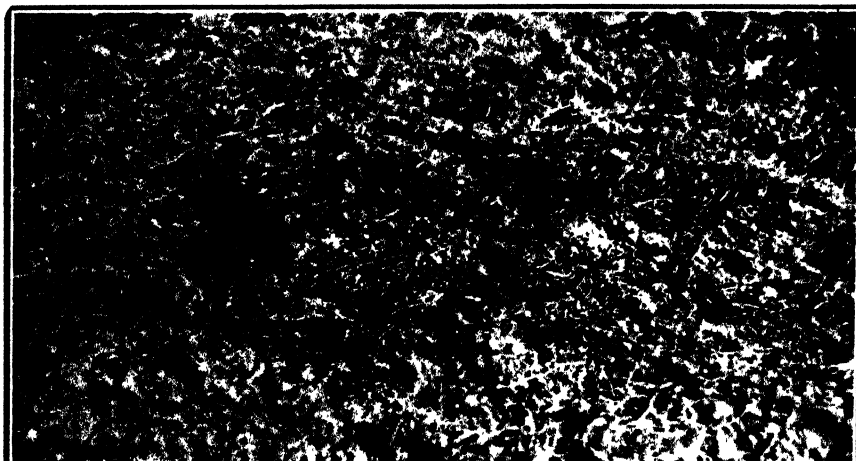


FIG. 2. BAD PATCH OF TALL COUCH IN 22-ACRE Paddock WHERE OATS AND TARES
CROP WAS FED OFF—NOT SEEDED.

It will be readily admitted, after considering the evidence furnished by the paddock which has been systematically cropped for seed tares, that the result after three years is highly satisfactory. The old system of scarifying and summer fallowing as generally practised in Canterbury cannot compare for effectiveness with the system here recorded.

Phosphatic fertilizers are of three types: (1) Phosphate immediately available—superphosphate; (2) phosphate moderately available—basic superphosphate; (3) phosphates slowly available—basic slag, rock phosphate, bonedust.

IMPORTATION OF FERTILIZERS, 1926-27.

Chemistry Section.

STATISTICS of artificial fertilizers imported into New Zealand during the year ended 31st March, 1927, have been prepared as usual from figures specially supplied by the Comptroller of Customs, and are presented in the accompanying tables, together with comparative data for preceding periods.

TABLE I.—SUMMARY OF FERTILIZER IMPORTATIONS, 1926-27 AND 1925-26.

Fertilizer.	Quantity.		Declared Value	
	Year 1926-27.	Year 1925-26.	Year 1926-27.	Year 1925-26.
	Tons.	Tons.	£	£
Bonedust	1,805	2,085	15,932	18,851
Bone-char .. .. .	..	300	..	1,270
Basic slag	53,327	44,314	185,130	139,136
Superphosphate	15	500	89	1,856
Nauru and Ocean Islands phosphate	125,709	77,797	105,803	98,827
Island phosphate (other)*	35,832	19,691	56,868	34,272
Egyptian phosphate	5,979	10,037	18,730	32,363
American rock phosphate	21,977	..	32,485	..
Nitrogenous guano .. .. .	..	20	..	236
Kainit	2,195	3,110	6,295	8,214
Muriate of potash .. .. .	..	25	..	145
Sulphate of potash	2,016	1,356	19,740	13,726
Potash (other)	6,474	4,238	27,565	16,749
Gypsum .. .. .	..	1,402	..	2,220
Sulphate of ammonia	957	1,227	12,862	17,037
Nitrate of soda	1,466	1,281	17,057	16,033
Sulphate of iron	61	67	658	743
Fertilizers unspecified	57	..	640	247
Totals	257,870	167,462	559,863	401,927

* For details see Table 3.

TABLE 2.—IMPORTS OF THE PRINCIPAL PHOSPHATIC FERTILIZERS, 1917-27

Year ended 31st March,	Bonedust.	Basic Slag.	Superphosphate.	Pacific and Indian Oceans Phosphates.	Egyptian Basic Phosphate.
	Tons.	Tons.	Tons.	Tons	Tons
1917	10,386	6,660	31,902	24,993	8,614
1918	6,363	10	37,157	37,037	11,225
1919	3,468	Nil	21,400	31,351	Nil.
1920	6,272	2,759	15,842	38,861	15,000
1921	4,440	10,823	40,731	70,208	10,810
1922	4,063	13,488	3,140	45,956	Nil.
1923	2,446	19,641	Nil	69,591	..
1924	4,158	39,632	255	76,517	5,996
1925	2,452	45,682	10	108,163	8,530
1926	2,085	44,314	500	97,488	10,037
1927	1,805	53,327	15	161,541	5,979

TABLE 3.—IMPORTATION (IN TONS) OF PRINCIPAL ARTIFICIAL FERTILIZERS FOR YEAR 1926-27, SHOWING COUNTRIES OF DEPARTURE AND NEW ZEALAND PORTS OF ENTRY.

New Zealand Port of Entry.	Australia.		Chile.	India.	Pacific and Indian Oceans Islands.		United Kingdom.		Belgium.		France.		Germany.	Egypt.	United States of America.	
	Nitrogenous Manures.	Bone-lust.	Nitrate of Soda.	Bone-lust.	Name of Island	Phosphate.	Basic Slag.	Potash.	Basic Slag.	Potash.	Basic Slag.	Potash.	Potash.	Phosphate.	Nitrogenous Manures.	Rock Phosphate.
Auckland..	287	155	1,460	650	New Caledonia ..	442	..	..	..	..	..	..	..	..	..	150,14,673
					Seychelles ..	1,429	3,455	145,20,203	125	..	100	3,306	2,386	..	..	..
					Surprise ..	3,881	..	..	..	..	..	..	..	..	..	..
					Malden ..	2,245	..	..	..	..	..	..	..	..	..	..
					Nauru ..	44,382	..	..	..	..	..	..	..	..	..	..
					Makatea ..	10,946	..	..	..	..	..	..	..	..	..	..
					Ocean ..	31,715	..	..	..	..	..	..	..	..	..	..
New Plymouth	50	..	..	..	Nauru ..	14,145	10,191	71	..	165	9,460	470	1,212	..	..	..
					Ocean ..	3,884	..	..	..	..	..	..	..	..	..	..
					Seychelles ..	1,040	..	..	..	..	..	..	..	..	..	3,353
					Makatea ..	5,311	..	..	..	..	..	..	..	..	..	..
Wanganui	25	..	..	..	..	..	151	..	..	..	..	..	..	..	..	..
Napier ..	..	..	..	..	..	..	3,251	..	50	..	..	25	..	750	..	..
Wellington	48	..	..	..	..	..	275	..	4,066	10	..	304	185	2,273	..	..
Nelson ..	10	..	..	..	..	..	..	..	200	..	..	45	10	..	..	..
Lyttelton..	210	..	..	..	Walpole ..	1,600	125	100	..	..	..	200	140	..	..	3,951
					Nauru ..	15,681	..	..	..	..	..	..	..	..	..	..
					Ocean ..	6,587	..	..	..	..	..	..	..	..	..	..
Timaru ..	..	..	..	..	Walpole ..	657	10	15	..	..	..	60	10	..	..	..
					New Caledonia ..	950	..	..	..	..	..	..	..	..	..	..
Dunedin ..	97	..	..	..	Seychelles ..	2,871	220	15	100	..	..	206	172	..	..	..
					Nauru ..	5,024	..	..	..	..	..	..	..	..	..	..
					Ocean ..	2,276	..	..	..	..	..	..	..	..	..	..
					New Caledonia ..	2,320	350	75	1,120	..	..	648	480	2,956	..	..
Invercargill	80	..	..	..	Seychelles ..	2,010	..	..	..	..	..	..	..	..	..	..
					Nauru ..	2,015	..	..	..	..	..	..	..	..	..	..

NOTE.—Importations of rock phosphate from United States, shown in last column, were made by the British Phosphate Commission to supplement its ordinary supplies from Nauru and Ocean, temporarily held up by shipping delays due to bad weather at those islands.

POSITIVE AND NEGATIVE RESULTS IN FIELD EXPERIMENTS.

A "POSITIVE" result in field experimental work may be defined as one in which a treatment gives an increase irrespective of whether it is profitable or not; a "negative" result is one in which no benefit is derived from a treatment.

Great prominence is generally given to experiments which exhibit outstanding and visible positive results, especially if such results fit in with preconceived ideas of what should happen when any particular treatment is applied. On the other hand, very little is heard of those cases where negative or apparently negative results are experienced. These remarks apply in general to observational experiments such as those commonly conducted by farmers.

In the case of outstanding positive results the experiment, if in a prominent position, is self-advertising, and naturally calls forth comment and inquiry. In any case, the responsible individual generally feels rather proud of his achievement and loses no opportunity of bringing it to the notice of his fellows. The negative type of result is often lost sight of, chiefly because there is nothing to claim attention, and the individual concerned with the trial often considers his efforts wasted, becomes discouraged, and does not care to advertise his apparent failure.

It should be borne in mind that a negative result from a treatment is just as valuable a contribution to knowledge as is a positive one, for it is just as important to know when and where a certain application is likely to be of no avail as it is to know when or where it is profitable. In any case there are always certain departures from the general state of affairs. If results were always concordant there would be no need for other than the minimum of experimental work. Sir A. D. Hall, in referring to the truth of results of field experiments, has summed up the position in a very few words. He says: "There is no such thing as absolute truth, and what we want to find is that which is true as a whole, though it may be contradicted by parts of the whole."

It will be noticed that a distinction has been made between negative and "apparently" negative results. That a result is negative can only be determined by a carefully planned experiment. A difference to be visible, particularly in the case of a heavy crop, must be fairly considerable, and though not discernible by eye may be highly profitable. The same may apply to a lesser extent with a lighter crop. An example of such is recorded in last month's *Journal* (page 259) in the case of the pasture top-dressing experiment on the farm of F. W. Carpenter, Prebbleton, where both lime and lime plus super applications proved beneficial to a profitable extent when their effect was measured over two seasons. A more striking example is that recorded in the *Journal* for June, 1925, page 395, dealing with another top-dressing experiment, on W. G. Macartney's farm, Tai Tapu.

—A. W. Hudson, B.Agr., B.Sc., Instructor in Agriculture, Christchurch.

SEASONAL NOTES.

THE FARM.

WINTER TILLAGE.

DURING the coming month ploughing should be pushed ahead for spring crops as conditions permit, but never while the land is sodden. There is more latitude in the case of old pasture being turned, as this does not bake so readily if ploughed somewhat wet, but even so it should not show a glazey furrow.

In Canterbury and North Otago the breaking-up of grassland preparatory to the sowing of wheat should be carried out in winter. Through the action of frost having the beneficial effect of pulverizing the soil the maximum of water can enter, and storage of moisture against dry conditions which may ensue is greatly promoted. In cases where wheat has not been sown by about the middle of June it will be as well to postpone sowings until the beginning of August.

THE MANGOLD CROP.

If not already done, the next few weeks will provide a good period for pulling the mangold crop, so that the roots may have time to ripen before being fed. Some farmers are inclined to leave the roots in the ground, with the idea that they will grow a bit more. They may certainly grow a little, but the extra material will be of poor value. The best practice is to pull or harrow out the crop not later than June, screw or cut off the tops, and stack the roots in a good dry position, giving a light covering of straw or fern to keep out the frost. If the roots cannot be carted off, they should be thrown into rows in the field and allowed to ripen there. Where frosts are experienced there is danger of the roots being frosted during the first two or three days after pulling, but when they have been out for a week there is very little danger. The moral is not to start pulling during a spell of hard frosts, but to choose a time when there is every appearance of the weather being mild for a few days.

DRAINAGE.

Drainage should be given attention after heavy rains. In case of wet patches showing over known lines of underdrainage these places should be opened and examined with the object of remedying defects. A whole length of drain may easily be ruined by silting up.

Pastures that are apt to become sodden in winter are much improved by underdrainage, and mole ploughing is generally the cheapest method by which this can be accomplished. The value and effectiveness of mole ploughing on heavy retentive soil is not realized by many farmers. On such land surface water may often be found lying within 6 ft. of surface drains right up till late spring, and even then percolation is slow. Mole ploughing will remedy this. These drains last for a long period in stiff soil; but even if they have to be renewed every few years the operation may be reckoned a profitable undertaking.

LIMING AND MANURIAL TOP-DRESSING.

Liming may be continued during June. Stiff tenaceous clays can be greatly improved by lime, both in a mechanical and chemical sense, provided drainage is satisfactory. Manurial top-dressing also exerts its greatest influence when the soil has a sufficiency of lime, and stock are healthier. On these clays upwards of 1 ton per acre of burnt lime will greatly assist towards a better textured and freer working condition, while on the freer types of soil, but where excessive acidity is present, ground limestone is satisfactory.

Pasture top-dressing with artificial manures will still be in progress. Slow-acting fertilizers should now be applied as soon as possible if early benefit is to be expected.

SUPPLEMENTARY FODDERS.

From now on the growth of grass will be gradually falling to its winter minimum, and the supply of available fodders to both flock and herd should be correspondingly increased. The later-sown white-fleshed turnips will be nearing a finish, and the feeding of the swede crop probably started, while mangolds should be held in reserve for later use. In all cases a sufficiency of hay must be provided for the dairy herd, and sheep feeding off roots must be allowed a good run-off on pasture where the animals can provide themselves with the roughage so necessary to assist digestion. Intelligent and proper utilization of fodder crops means better health and a lowered death-rate among the stock.

Green catch-crops and temporary pastures sown in early autumn should soon be reaching usefulness, and if grazed lightly will also be of great assistance during the next two or three months.

The provision of ensilage deserves more attention than has hitherto been given to it, especially in those localities where spring cultivation is difficult, and where roots and other fodders are in consequence sown very late and the subsequent yields somewhat handicapped. Again, in such localities it is often difficult to feed off or cart out roots in the late winter and early spring, owing to the extremely wet condition of the land. Such country as a rule provides an overabundance of grass and clover growth during early summer, which could be preserved as ensilage and fed to stock as required in the lean periods.

TREE-PLANTING.

June is an excellent month for tree-planting on the farm, whether for shelter purposes, fencing-timber, or fuel. Hillsides which show signs of slipping and waste ground in various places may be profitably utilized in this manner, while the function of strong-growing trees in suppressing noxious-weed growth is also an important consideration. It is essential that all young plantations should be securely fenced from stock.

CONCRETE-WORK.

Concreting in cow-sheds, yards, &c., should be attended to early in the off-season, so as to give the work ample time to mature and harden before use. Where concrete is required to be moisture-proof, $\frac{1}{2}$ pint raw or boiled oil per bucketful of material can be added.

—*Fields Division.*

THE ORCHARD.

CULTIVATION AND MANURING.

Ploughing, if not already commenced, should be put in hand at once, as recommended in last month's notes. It is advisable to plough to the trees, leaving an open furrow along the middle of the lands between the rows of trees, so that any water collecting in the open furrows may be as far away as possible from the main roots of the trees.

Where required lime may be applied to the soil at the rate of from 10 cwt. to 20 cwt. per acre. During the winter months slow-acting manures—such as blood and bonedust, at $2\frac{1}{2}$ cwt. per acre; potash salts (30 per cent.), $1\frac{1}{2}$ cwt.; and superphosphate, 3 cwt.—should be applied where such fertilizers are required, as they are not readily washed out of the soil and will be available to the tree-roots in the spring.

PLANTING.

The autumn planting-out of fruit-trees should be completed by the third week in May. Where this is not practicable planting should be delayed until the spring, when the ground has become reasonably dry and warm, so that the trees may quickly establish their roots in the new position in which they are placed. Plant as early in the spring as the situation will allow, and preferably before growth begins. On receipt of the trees from the nursery open them up, and if the roots are dry moisten them, and cover with moist sacking or straw; or if planting is not to be proceeded with immediately heel the trees in the soil. The roots should be exposed as little as possible to the sun or to the drying influences of the atmosphere. For heeling-in dig a shallow trench about 24 in. wide and 8 in. deep. The bundles should be opened and the trees set closely side by side in the trench. Shake loose soil among the roots until they are completely covered, and then firm the soil. As mentioned last month, the land should be well worked before the trees are planted. Deeply worked soil is very beneficial to the development of a good deep rooting-system, and to obtain this condition subsoiling is recommended.

The proper depth of planting is very important. Trees require to be planted at about the same depth as they were in the nursery. If they are planted too deeply they will not do well, and if planted too shallow they are liable to be blown over and to root-injury when the land is being worked. Dig the hole to the required depth and dimensions to accommodate the roots, break up the bottom of the hole, and leave the soil higher in the centre of the hole than towards the sides. Shorten back the roots, and pay particular attention to the removal of damaged and injured portions. Mix well into the soil to be used in covering the roots two or three handfuls of fertilizer, such as blood, bone, and superphosphate. Avoid bringing unmixed fertilizer in direct contact with the roots. Make the soil as firm as possible around the roots, so as to bring the soil in close contact with them and to hold the trees firmly in the ground.

The top of the tree should be pruned immediately after planting in order to ensure full success. In the transplanting from the nursery a very considerable portion of the root-system of trees is destroyed, and to offset this loss the top must be cut back.

GRAFTING.

In many orchards there are a number of unprofitable varieties of the various kinds of fruit being grown. It is recommended that such varieties be worked over in the spring to one or more of the varieties which are more profitable and suitable to present-day market requirements. These trees should be marked, so that time will not needlessly be spent in pruning them. Arrangements should be made at once for scions with which to do the grafting. The scion wood should be carefully selected from trees having the desired characteristics and a good cropping record. The wood should be of the past season's growth, dormant, at least the thickness of a lead-pencil, and well matured. Securely label each bundle of scions, and place them in sand in a shady and comparatively dry spot until required in the spring.

MARKETING.

The same careful attention is required in marketing the later varieties as was given to the earlier sorts. It is strongly recommended that all fruit which has been in storage for a time should be repacked, and unsound fruits removed. To some growers repacking may be a trouble, and on this account a number are disposed to avoid the additional expense and market their fruit without resorting to it. It is important that the store in which the fruit is held should be well ventilated, this being to some extent a prevention against rots and decay.

PRUNING.

This important seasonal operation is dealt with at some length in a separate article elsewhere in this issue of the *Journal*, to which orchardists are referred.

—W. K. Dallas, Orchard Instructor, Dunedin.

Citrus-culture.

Harvesting.—At this season it is advisable to pay careful attention to the fruit to be harvested. Poorman oranges may with advantage be allowed to condition on the tree; large sizes intended or suitable for dessert purposes may be left to attain full maturity. The longer they are allowed to remain on the tree the more palatable they become, and are consequently more likely to encourage consumption as a breakfast fruit and thus stabilize the demand. Smaller sizes for preserving should not be removed from the tree until a good deal of colour has developed, sufficient at least to give attractive appearance, and maturity enough to ensure that the fruits will improve in condition, not wilt and toughen.

Sweet oranges should be allowed to hang to mature, as flavour and sweetness become more pronounced than if the fruit is picked semi-

green and matured off the tree. On the other hand, overmaturity and dryness should be avoided; but this condition is not usual until new foliage appears on the trees during September, except when the fruit is frosted.

Lemons should be cut as the desired stage is attained and the fruit is changing from greenish-silver to light-yellow colour. These when cured and stored become better marketable fruits than those altered to yellow on the tree, apart from the drain on the vitality of the tree in maturing them. Periodic and prompt harvesting is very desirable during the winter season, in order to reduce to a minimum the skin blemish occasioned by chafeing under high winds and puncture from thorns on thorny varieties.

Brown-rot.—Under winter conditions citrus brown-rot is to be expected, and unless precautionary measures are taken, supplemented by control measures on appearance, this disease may do much damage to the grove. Control measures are of a threefold character: First, cut away any branches or twigs which are within 18 in. of the ground to minimize risk from spores splashed up. Secondly, apply pulverized sulphate of iron over the surface soil at the rate of 2 oz. per square yard, covering a rather larger radius than the spread of the tree, raking it in lightly to destroy spores which are resident in the soil. Thirdly, apply bordeaux 4-4-40 to trees at four-weekly intervals throughout the winter to prevent the establishment of any spores which may lodge in the fruit or foliage. All these measures are directed against spores which are present in the soil, having been deposited there by fallen fruit or leaves. The efficiency of the measures is prejudiced by allowing fallen fruit to decay about the trees, and non-attention to the collection and destruction of fallen diseased foliage.

Planting.—Land on which it is intended to plant citrus-trees this planting season should be prepared as soon as possible by deep cultivation and perfect drainage. If this work is done early the land will be prevented from becoming waterlogged, and will be in nice sweet condition for planting during spring.

W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

AUTUMN EGGS.

IN poultry-keeping it is now recognized as an established fact that eggs should be produced in good numbers throughout the dear season if maximum returns are to be secured from the business. Obviously, there can be no comparison between a bird laying the bulk of her eggs during the dear season and one producing her main yield in the cheap season when practically any sort of fowl will lay. The fact of fresh eggs commanding such a high level of value during the recent autumn months is sufficient to indicate how many poultry-keepers there are who have yet to learn how to produce eggs at this season of the year.

At one time autumn-produced eggs realized but little more than those produced during spring and summer, but this has not been the

case during recent years. For example, during February, March, and April this year, the price of eggs in Wellington gradually rose till they were being retailed at 4s. per dozen. As a result those poultry-keepers who hatched out good numbers of chickens during July and who managed their flocks on proper lines reaped a good reward. These results were attained by reason of the fact that none but the late moulters—those birds which gave promise of being long-season layers—were retained in the flock. The early moulters and poor layers had been previously got rid of. Under this system of management, together with the high ruling price for eggs, a good margin of profit over and above the expenses of running the plant was secured. In fact, one big producer informed me that he secured his biggest weekly returns for eggs during the autumn months. This is a striking contrast to the returns secured on the great majority of plants at this period of the year, where the eggs gathered do not pay for the food consumed.

It may be contended that the bulk of the July-hatched pullets will moult in the late autumn, and that there will be a loss of winter eggs as a result. It is quite possible that they will, but on a well-managed plant there should be later-hatched pullets specially bred to lay during the cold months of the year. In any case the early-hatched pullets will not all moult and cease to lay at exactly the same time, providing, of course, they are properly fed and managed. With such birds it will generally be found that eggs in a more or less number will be obtained right throughout the dear season. Naturally, some of the birds will moult early and cease to lay, but others will continue producing, so that when the latter are moulting the former will have renewed their feathers and be ready to resume laying. Then again, owing to the fact of such birds moulting during the late autumn or early winter, they can usually be depended upon to lay well into the autumn or early winter during the following year when the price of eggs is on the up-grade.

Usually, the poultry-keepers' most lean period is from, say, the middle of March to the end of May or even June. The adult stock are then taking their period of rest, either preparing for or undergoing the moulting process. Further, probably owing to late hatching or through indifferent management, the pullets fail to produce when expected. This means that there is much money going out and little coming in. If the maximum returns are to be secured sufficient eggs should be collected to at least balance expenses. Just as the successful market-gardener aims at a rotation of crops and something to sell in each month of the year, so must the poultry-keeper organize a similar position if his business is to be really profitable.

Almost daily I receive complaints from poultry-keepers who have tried to secure eggs in the dear season but have failed in their objective. Usually, this is put down to the same old trouble—namely, bad luck—and so it goes on from year to year. There are others, however, who combine common-sense management with strict attention to details, and who conduct the business in a methodical manner. These somehow never have the so-called "bad luck." At times, of course, they make mistakes, but these are seldom of any moment. They succeed in the little things that really matter, and

thereby make poultry-keeping the profitable business it is to those who thoroughly understand it, and treat it as a serious proposition to be mastered and conducted on the same strict business principles as any other rural industry.

After all, there is no great secret in securing autumn or winter eggs. These can be produced without fail by following rules which, when combined with common-sense, are simple and easily effected. To those who have asked my advice relative to pullets failing to lay when expected, and others who have had a similar experience, I would suggest that they ask themselves the following questions: When were the pullets hatched—too early or too late? Were they bred from tested winter-laying stock? Were they properly reared? Was the class of food altered too often, or was an inferior food purchased because it was cheap? Was old wheat suddenly changed to new wheat (a common cause of poultry moulting)? Did the birds receive a regular supply of animal food, so imperative for the production of eggs in the dear season? Were green food, grit, and clean water always available? Did the birds contract colds and spread them through the flock, by reason of a draughty house and failure to find the cause, or were the houses overcrowded or insufficiently ventilated? Were the birds and houses infested with vermin? Had the runs been allowed to become poultry-sick, and were the birds infested with intestinal parasites from this cause, or was there any attempt made to run the pullets on clean ground so essential for their welfare?

Even these questions do not cover the whole field which calls for investigation to account for much of the so-called bad luck. It may be taken for granted that if the birds are well housed, well fed, and generally receive common-sense management, and yet do not lay well, they are a poor laying strain. In such cases the best remedy is to get entirely new blood of a strain noted for egg-laying power.

TIME TO MATE.

It should not be forgotten by poultry-keepers who desire to secure a good yield of eggs in the autumn of next year that the breeding-pens should be mated up during the coming month. This will give the birds an opportunity of getting well settled down, so as to enable chicks to be hatched out early in July. It may be mentioned in this connection that adult birds are seldom laying at this period of the year, and in order to secure early chicks the poultry-keeper is obviously forced to use pullet-eggs for incubation. Breeding from pullets is not generally recommended, but for the production of winter eggs an exception must be made.

When using pullets for this purpose special care should be taken that they are well developed and possess strong points indicative to constitutional vigour, such as bright prominent eyes, well-developed crop, tight feathering, and generally an active businesslike appearance. When pullets are to be bred from they should be mated, where possible, with an adult male. Breeding from pullets and cockerels should be avoided wherever possible.

Unfortunately, many who depend on the natural mother for rearing chicks are forced to hatch late owing to their inability to secure broody

hens. One means available to the small poultry-keeper for overcoming this difficulty in timely hatching is the securing of day-old chicks from reliable specialists in the production of heavy-producing stock. Such chicks can be satisfactorily reared with a fireless brooder, provided the necessary attention is available, while there are also more or less inexpensive lamp-brooders on the market which can be depended upon to give good results.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

TREATMENT OF WAX.

AFTER the honey crop is disposed of and the bees are settled snugly in their winter quarters the beekeeper should give attention to clarifying his wax. Where a solar extractor has been used during the summer it will be a simple matter to collect the cakes of wax which have been melted in this manner and reduce them to one or two large cakes; but where a number of combs is to be treated a wax-press is an almost indispensable article in the apiary equipment. For handling wax in large quantities the press now known as the Root wax-press is best. No special building is needed for wax-melting; an ordinary washhouse answers the purpose admirably. Choose a cold day for the operation, since nothing excites the bees during the off season like the smell of hot wax.

Commencing operations, fill the copper half full of water, and when this is heated place the combs—which must have been removed from the frames—in the hot water. Have a strong stand ready to support the wax-press, and inside this place a kerosene heater, so arranging it that the flame comes in direct contact with the bottom of the press. Fill the water-compartment of the press with boiling water, which the heater will now keep boiling, and in the perforated basket of the press place a coarse scrim bag large enough to reach to the bottom of the basket. The combs in the copper should be stirred with a stick until the wax is all melted, and the contents of the copper—water and wax—should then be ladled into the scrim bag in the press. The top of the bag should now be folded so as to allow of one or more of the wooden “followers” belonging to the press to be placed on top of it and the screw placed in position, when a stream of water and wax will immediately commence to flow from the outlet provided in the press. A kerosene-tin or similar vessel should be placed in position under the outlet.

Two precautions are necessary in using a wax-press. Pressure should at all times be applied with caution. Until the flow from the press slackens the screw should not be turned, and when it becomes necessary to apply pressure this should be done without appreciable effort. The screw should always turn easily. It will be found that if this advice is taken the maximum of wax will be obtained with very little risk to the machine. Another point to be borne in mind is that only a comparatively small quantity of water and wax must be put into the bag at each ladling. It is difficult to exactly estimate how much to treat at once, so much depends on the proportions of

wax and water, but on no account attempt to fill the scrim bag at one operation. When the wax and water cease to run from the outlet the bag should be removed and the slumgum emptied out before the press is required to deal with any more wax.

As the copper will contain a great deal of water it is an excellent plan to keep a kerosene-pump in the vessel placed to receive the contents of the press. If this is sunk to the bottom of the vessel it will draw off a great deal of the water, leaving the wax, which will, of course, be on top, untouched. This will result in the wax being gathered in far larger cakes than if several vessels are used. The wax should be set aside to cool as gradually as possible, this being best achieved by covering the tin containing it with corn-sacks or similar material. The gradual cooling helps to clarify the wax. When it is quite cold the cake should be taken out of the tin and carefully scraped.

The tin should now be washed out and partly filled with clean hot water, the cake of wax replaced, and the whole gradually heated until the wax is once more melted. After this second process the whole should be slowly cooled as before, and when the wax is once more removed and scraped it will have reached its commercial form. The wax-press and copper should be cleansed while still hot. The water should be emptied out of its compartment in the press at once, and the press placed to drain in order to prevent rust. The slumgum must be gathered up and burnt, and the bag washed and dried for future use.

BEEKEEPERS' CONFERENCE.

The annual conference of beekeepers will be held at Christchurch on 7th, 8th, and 9th June. It is expected that all parts of the Dominion will be represented. Papers in connection with the Hopkins memorial scheme will form a feature of the Conference. This year's subject is "The Economical Production of High-class Honey for Export." Competitions for the best collection of honey-producing plants, marked and correctly named, also for honey and beeswax, are to be held.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

THE HOMESTEAD GARDEN.

MOST farm homes have a garden, as it improves the appearance and value of the property, besides giving pleasure to its members. Practically all the requirements of a garden are at hand, and an ample and seasonable supply of fruit and vegetables is among the advantages of country life. In some instances, however, this pleasure and profit are at a discount, and work in the garden is unpopular. Why should this be so? In most cases it is due to the moderate results obtained, owing to the design being complicated, with a number of narrow borders and small beds filled with a large collection of herbaceous plants, shrubs, and weeds. The temptation to plant a little of everything that appeals to one's taste is hard to resist—a corner is found, and in it goes to

make the confusion worse. This practice results in chaos and weeds—hence the discouragement. It is very true that nothing succeeds like success, and effective results are required to inspire that enthusiasm which will make the work popular and give the worker pride in his achievement. These results are readily obtained if a convenient, simple design is carefully thought out first and carried out afterwards. The present time is very suitable for making such alterations.

Dry paths are required, but too frequently there are far too many of them. They demand a great deal of attention to keep them effective and looking well, while it is to be remembered that good short grass is much pleasanter to walk on, and on very few occasions it is unpleasantly wet. Only where the traffic is so great as to wear a track should a path be made, and with this rule operating very few will be required.

The home gardener is wise in cutting up his lawns as little as possible by forming his walks and drive as far as can be about the sides of the lawn. And where the lawn and the walk meet a neat outline is secured by a short grass verge, but where it runs beside a shrubbery or herbaceous border a problem arises that is not always very successfully dealt with. An edging of sawn timber which is so commonly used is not satisfactory for long; the conditions soon cause it to warp and decay, and so it contributes to discouragement. In large gardens a strip of grass 2 ft. or 3 ft. wide usually solves the problem, but that is rather difficult to lay down, and requires a great deal of work to maintain. A rock verge is sometimes used, but in flat country it looks a little out of place, although in broken rocky country it may very well be used with best results. Otherwise, if the walk or drive is adjoining a shrubbery, dwarf shrubs, such as the veronicas of different species, and senecios, planted close enough to touch, give an evergreen definition that is effective with little labour. Where an herbaceous border adjoins the path an evergreen carpet-plant, such as pinks, mossy phlox, or violets, serves the purpose.

This brings one to the most unsatisfactory sections of the type of homestead garden with which we are dealing—those miscellaneous collections of herbaceous and bulbous plants matted up with twitch-grass and sorrel. This material is best dealt with now by lifting the whole lot out and carefully sorting the good plants from the weeds before heeling them in a piece of spare ground. Some of the little beds and narrow borders will be best laid down in turf after firming and levelling the soil.

The area selected for the herbaceous border, while prominent and bold in outline, should be moderate in extent. Although it makes a good foreground to the tall shrubbery border, there is a tendency to make this a rule, and as a result the area devoted to this purpose is comparatively too great. By confining this class of planting to a border or two close by the house and the margin of one or two of the more prominent shrubberies not only is the amount of work greatly reduced, but a varied interest is also created that is more attractive.

Having decided on the localities for these borders, they should be carefully outlined and properly trenched with a generous application of fermented organic manures worked into the lower spit. It may not be superfluous to remark here that all twitch and such bad weeds should be carefully picked out, as this is most important. After trenching the

ground do not be in a hurry to plant ; let the land settle, any weed-seeds germinate, and roots of weeds sprout, so that they can be dealt with ; thus the land may be thoroughly cleaned. After this a heavy dressing of blood-and-bone manure, 4 oz. to the square yard, may be lightly dug in, and shortly before planting an application of 2 oz. super-phosphate per square yard may be hoed in. Planting may then be done at any time when the land is dry. Effective appearance and economy in maintenance will be best obtained by arranging the different varieties and species of herbaceous plants in rather large irregular groups than in mixing them together in the usual way. The blossom-colours show up brighter in that way, and the contrasts and harmonies may be made to which the effect is due. Plant so that when the plants are in full growth the ground is covered with foliage ; it looks better, and there is very little weeding to be done. All that is required is to restrain the exuberance of some of the more vigorous members.

The Vegetable Section.

The unsatisfactory vegetable section in the homestead garden is usually one in which short rows of vegetables in considerable variety are mixed with bush fruits in such a way that little or nothing does really well, and what poor achievement is secured is at the expenditure of a great deal of back-aching hard work. Such a state of affairs may be often best dealt with here by dispensing with the annual vegetable crops altogether, and devoting the area to bush-fruits, strawberries, herbs, and such permanent crops as rhubarb and asparagus. Such an association can be made with every prospect of success.

For the family vegetable-supply it is recommended that an area adjoining the annual farm root crops should be reserved, even if it be only the headlands of the paddock. Planted in rows rather long and wide, most of the work may be done by horses more expeditiously, and most of the disturbance avoided. On most farms a crop of mangolds and carrots are required for the stock, and to extend the planting with vegetables for household requirements has been proved a very satisfactory practice.

QUALITY AND SUITABILITY OF SEED.

It is a fact that strangely few planters give the requisite attention to the characteristics of the seed they purpose to sow. Too often the result is a thin crop of moderate quality, afflicted by disease, a source of anxiety, and requiring extra manures and a great deal of spraying to attain merely a moderate result. The calamity varies from time to time, and assumes a number of different distressing features that lead to a heavy correspondence with those who undertake to give horticultural advice. Of the various factors that contribute to successful cropping, that of the seed is one of the most important, and is quite often entirely overlooked. A sower should assure himself that the seed he is planting is the most suitable variety for the place and purpose, that it is of high strain, free from disease, and of a known percentage of germination. The importance of each of these points will vary with the different kinds of seeds dealt with. It is specially desirable to know the germination percentage, as it is then possible to adjust the drills

to sow at a rate that will give an even stand with little or no thinning, and thus secure a very great economy.

Potato-seed strain is often deficient, and scab, wilt, rhizoctonia, and late-blight diseases are sometimes found among them. Through being heated and stored in the dark, potato-seed is sometimes devitalized by making long premature growth that renders it comparatively useless for seed purposes. Clean potato-seed of a good variety and strain should be obtained early in the season and now stored in a light airy cool position. These conditions will protect and ripen the buds in the eyes of the potatoes, and induce a short strong growth at the right season.

—W. C. Hyde, *Horticulturist*.

IMPORTATION OF HAY, STRAW, OR CHAFF.

THE regulations under the Stock Act, gazetted on 6th March, 1924, in so far as they relate to hay, straw, or chaff used as packing or otherwise with goods imported into New Zealand from Great Britain, Ireland, and the Continent of Europe, were revoked as from 25th March current, and the following regulations have since applied :—

1. The importation into New Zealand, either direct or by way of any other country, from Great Britain, Ireland, any part of the Continent of Europe, Argentina, Uruguay, Paraguay, Brazil, and Chile, of hay, straw, or chaff is hereby prohibited, save with the consent of the Minister of Agriculture, except where such introduction takes place in accordance with these regulations: Provided that these regulations shall not apply to any articles of millinery or other articles constructed wholly or partly of braided, interwoven, or plaited straw.
2. Hay, straw, or chaff used as packing-material for goods manufactured and packed in Great Britain may be imported upon production to the Collector of Customs at the port of entry of a certificate or declaration, either on or with the invoice from the exporter or packer, countersigned as correct by a responsible officer appointed by the High Commissioner for New Zealand for the purpose, to the effect that the hay, straw, or chaff used has been either—(a) Subjected to the action of live steam, and maintaining in all parts of the compartment a temperature of not less than 185 degrees Fahrenheit for a period of at least ten minutes; (b) placed loosely in a tight compartment having a temperature of not less than 65 degrees Fahrenheit, and thoroughly sprayed with 10 fluid ounces of formaldehyde solution (containing not less than 37 per centum of formaldehyde by weight) for each 1,000 cubic feet of space in the compartment, which was immediately closed in a manner to prevent the escape of the formaldehyde vapour, and kept closed for not less than 8 hours; or (c) placed loosely in a tight compartment and subjected to the action of heat in the presence of moisture at a temperature of not less than 260 degrees Fahrenheit, and maintaining this temperature throughout the whole of the chamber for a period of not less than two hours.
3. Where material of any kind other than hay, straw, or chaff disinfected and certified in accordance with clause 2 hereof is used for the packing of any goods imported from the countries hereinbefore mentioned, a certificate or declaration as to the nature of such material shall be endorsed on the invoice accompanying such goods, and be signed by the exporter or packer.
4. Straw envelopes intended for use in packing bottles may be imported from Great Britain upon production to the Collector of Customs at the port of entry of a certificate or declaration similar to that prescribed in clause 2 hereof.
5. Every person who commits a breach of these regulations shall be liable to a penalty of not less than £2 nor more than £100.

The regulations are an additional precautionary measure against the introduction of foot-and-mouth disease into this country.

VETERINARY SURGEONS REGISTRATION REGULATIONS.

THE following regulations under the Veterinary Surgeons Act, 1926 (which was published in full in the *Journal* for November last), have been gazetted :—

1. PRELIMINARY.

These regulations may be cited as the Veterinary Surgeons Registration Regulations, 1927.

2. INTERPRETATION.

In these regulations, if not inconsistent with the context,—

“ Board ” means the Veterinary Surgeons Board constituted under the said Act :

“ Registrar ” means the Registrar appointed under the said Act :

“ Veterinary Surgeon ” means any person duly registered under these regulations.

3. TRAVELLING AND LOCOMOTION EXPENSES AND FEE FOR ATTENDANCE.

(1) The Board may pay to any member of the Board all travelling and locomotion expenses actually and reasonably expended by him in respect of attendance at meetings of the Board.

(2) No claim of any member for travelling or locomotion expenses shall be recognized unless such claim shall be accompanied by a certificate of such member, setting out that he was engaged in connection with the business of the Board during the period claimed for. Such certificate shall be in the following form :—

I, *(Full name, occupation, and address)*, hereby certify that I was engaged in connection with attendance at meetings of the Veterinary Surgeons Board on the day claimed for, and incurred the travelling and locomotion expenses indicated in the claim.

(3) No payment of expenses under these regulations to any member shall be made unless such payment is first approved by a resolution of the Board

(4) The Board may pay to any member of the Board, not being a person in the employment of the New Zealand Government, the sum of two guineas for each day or part of a day while attending the meetings of the Board.

4. APPLICATION FOR REGISTRATION.

(1) Application for registration of veterinary surgeons shall be in accordance with Form A in the Schedule hereto.

(2) Any notification required by the said Act or these regulations to be given to any applicant for registration, whether before or after registration, shall be sufficient if sent by registered-post letter signed by the Registrar and addressed to the applicant at the address stated by him in his application, or any fresh address notified as hereinafter provided.

(3) Any document submitted with an application for registration may be returned to the applicant by registered-post letter to the address given in the application, or to any fresh address notified as hereinafter provided

(4) Any applicant may, either before or after registration, by writing addressed to the Board, notify a fresh address, and the Board may direct an entry of such fresh address to be made in the register.

5. REGISTRATION OF VETERINARY SURGEONS.

(1) The Register of Veterinary Surgeons referred to in section 5 of the said Act shall be kept in accordance with Form B in the Schedule hereto.

(2) The entries in the register shall be made in the order in which the directions to make the entries given under section 7 of the said Act are received by the Registrar.

(3) The Registrar shall also keep (either bookwise or by means of a loose-leaf or card system) an alphabetical index of the names of the persons entered in the register, and such index shall be deemed to be a part of the register.

(4) The qualifications by virtue of which a person is registered shall be sufficiently indicated by the usual abbreviation of any recognized certificate (including an indication of the institution by which the certificate is granted).

(5) The direction in writing of the Board referred to in section 7 (2) of the said Act shall be sufficient if signed by the Chairman and given pursuant to a resolution of the Board.

(6) The certificate of registration issued under section 8 of the said Act shall be in accordance with Form C in the Schedule hereto.

(7) Any person may, on payment of the fee hereinafter prescribed, obtain a copy, certified under the hand of the Registrar, of the particulars entered in the register in respect of any person.

6. CANCELLATION OF REGISTRATION.

(1) The name of every person removed from the register under section 10 of the said Act shall be published in the *Gazette*, and the Board may, if it thinks fit, state the ground of such removal.

(2) Such publication shall take place after the time for appeal under section 11 of the said Act has expired, or, if an appeal is lodged, after the decision of the Board of Appeal has been given or such appeal has been otherwise disposed of.

(3) Every certificate of registration issued to any person whose name is removed from the register as aforesaid shall be returned to the Registrar by such person within one month from the date of the publication in the *Gazette* of the notification aforesaid.

(4) Every person who, without just cause, fails so to return any certificate shall be liable to a fine not exceeding £5.

7. FEES.

(1) The fee for registration, including a certificate of registration, shall be £2 2s., which must accompany the application for registration.

(2) The fee for publication in the *Gazette* of the name of a registered veterinary surgeon shall be 5s., to be paid before the 1st March in each year.

(3) The fee for a certified copy of an entry in the register shall be 5s.

(The Schedule is not printed here; the form of application for registration may be obtained from the Registrar, Veterinary Surgeons Board, Department of Agriculture, Wellington.)

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Journal* from 10th March to 5th May, 1927, include the following of agricultural interest:—

No. 55322: Treatment of meat; J. A. Linley, London, England. No. 55340: Flax-treating; G. Craw, Linton. No. 55815: Milk-agitator; J. Feaver, jun., Opunake. No. 56340: Onion-topping machine; W. R. Curtis, Christchurch. No. 56431: Milk-purifier; F. O. Carbines, Auckland. No. 57754: Hay-lift; J. Hodson, Bannockburn. No. 56435: Cream-cooler; A. Coutts, Hukerunui. No. 57500: Sheep-shears; Chicago Flexible Shaft Co., Chicago, U.S.A. No. 57970: Fertilizer-distributor; May Brothers, Ltd., Gawler, S. Australia. No. 56361: Dehorning cattle; S. Armstrong, Tuhikaramea. No. 56429: Cleaning milk-cans; Watson, Steele, and Ganley, Ltd., Auckland. No. 57563: Manure-distributor; L. I. Howell, Paraparaumu. No. 55471: Transferring mutton from wharf to ship; J. Crestofanini, Christchurch. No. 55765: Subsoiling-device; R. L. C. Drummond, Riwaka. No. 56639: Teat cup inflation-ring inserter; T. N. Drummond, Hamilton. No. 57730: Milking-machine pulsator; R. Wallace, jun., Castle Douglas, Scotland. No. 58120: Spraying-apparatus; W. J. Denston, Birmingham, England. No. 55180: Dehorning cattle; H. Preston, Masterton. No. 56263: Gardening tool; W. Beamish, Hastings. No. 58097: Harrow; F. T. F. Evans, Auckland. No. 58174: Manure-sowing machine; L., B., G., and I. P. Hayes, Otarehua.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the Bank receipt sent to the Patent Office;

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

FUNGUS DISEASE IN ARTICHOKE.

F. P. LEA, Leamington :—

I would be obliged if you could tell me of a remedy for a disease which is affecting a crop of artichokes. For about a month past quite a few plants have been turning black in the leaf and dropping to the ground. The first indication of disease is apparent about 2 ft. from the ground, when the stalk goes dry and brown, followed by a withering of the leaves, and the tubers turn into a kind of milky pulp.

The Fields Division :—

The specimens sent are attacked by the fungus *Sclerotinia sclerotiorum*, an infection which is becoming rather common in artichoke crops. As the crop is no doubt ready for feeding off with pigs, there is a probability that the disease will spread throughout the patch. We would suggest that you plant a fresh area on clean ground, using seed taken from healthy plants. For greater safety, tubers should be dipped in formalin solution, 2½ per cent strength, before planting. All diseased stems in the affected crop should be pulled and destroyed by burning, as they help to spread the disease. Artichokes should not be sown again for five years in land known to be infected.

FERMENTING OF HONEY.

"BEEHIVE," HAKARU :—

Can anything be done to honey which has fermented and what is the cause of fermentation?

The Horticulture Division :—

If the honey has not turned sour the slight alcoholic ferment can be evaporated readily by melting over water, when the ferment escapes in the shape of foam. Honey, if not kept in airtight vessels, readily absorbs moisture from the air, and fermentation sets up. When removing honey from the hive see that the cells are all capped, or the unripe honey stored in the open cells will cause fermentation.

TREATMENT FOR DANTHONIA PASTURE.

"NORTH AUCKLAND," Waipu :—

I should be glad to know of the best treatment for pasture consisting of nearly pure *Danthonia pilosa*. I have about 50 acres of it, and the ground is clean, undulating, and ploughable. Owing to the grassland having been burnt and reburnt, other grasses have disappeared. The farm is about 300 acres, and all requires top-dressing. I believe poor ground should be dressed first, as stock will eat out the grass in good valleys in any case. (Can I improve the danthonia with top-dressing; and to produce good mixed pasture shall I require to surface-sow a mixture?) I do not wish to plough the land, although doubtless this would be the better plan.

The Fields Division :—

No doubt the continual burning-off of the danthonia has killed out the vestiges of English grasses which usually persist in such a pasture when not burnt, and resulted in the reduction of the surface fertility (especially the humus content) to much below the standard required by rye-grass and white

clover. Therefore top-dressing alone will not effect much improvement in the pasture beyond producing a more vigorous and palatable growth of danthonia, and probably bringing in *Lotus hispidus*. For the same reason the sowing of English grasses with the top-dressing is not advisable on the surface as it is. Heavy disking and tripod harrowing to break up the danthonia, and render some of it available as humus, as well as provide a better seed-bed for the following mixture (to be sown with the top-dressing) is recommended: Italian rye-grass, 2 lb.; perennial rye-grass, 6 lb.; crested dogstail, $\frac{1}{2}$ lb.; paspalum, 2 lb.; white clover, 1 lb.; a few ounces of subterannean clover per acre can also be included. A pasture renovated in this way would gradually improve with top-dressing. An alternative which may fit in with the farm-management is to plough and take a crop of soft turnips or rape, which should pay for the initial cultivation. After the crop is fed off about February and March, preferably with sheep, the land can be disked and sown with a permanent grass mixture, the crop residues and dung enriching the surface. This method would give a much better pasture. However, since this is presumably the poorest pasture on the farm and cannot be producing very much, it would be a much-better-paying proposition to commence top-dressing the better pastures, as they will give more economical and quicker returns for the expenditure. It is not so much a question of what the stock will eat as getting the most out of what they do eat, and it will be found that by top-dressing the poorer portions of a pasture a little more heavily the stock will tend to graze the whole of the pasture so treated fairly evenly. The renovation of the danthonia paddock might well be left until the rest of the farm is brought into good heart

BACON-CURING.

D. WITHERS, Paparoa :—

Kindly suggest a mild cure for pigs of about 200 lb. dressed weight, the bacon not being required to keep more than three months.

The Live-stock Division :—

There are two forms of curing for bacon—dry curing and brine curing—good recipes for both of which are appended. For a mild cure either way do not let the bacon pieces remain in salt as long as the times stated in either formulæ:

(1) Dry curing: Weigh out for each 100 lb. meat 5 lb. salt, 2 lb. brown sugar, and 2 oz. saltpetre. When the carcase is thoroughly set cut up and salt lightly, then lay it upon a clean concrete floor or table overnight. By "salt slightly" is meant that as much salt as will cover the meat comfortably without undue waste is used. Next morning brush the salt off thoroughly, then salt the meat with dry salt and brown sugar, rubbed well in daily for three days. On the fourth and fifth days a little saltpetre should be added to the salt and sugar, which should be well rubbed in, especially on the skin. Leave the bacon and hams in the mixture (dry salt and brown sugar) for about three weeks; but the hams and bacon should be turned every day or second day, and at the same time rubbing continued during this period. Wash clean when the pieces are ready for smoking, the duration of which depends upon the taste of the manufacturer. After the first week or ten days it is advisable to brush the salt and sugar off the inner side of the thin parts of the bacon (flaps). Dry salting should be undertaken only in cold weather and in a cool place.

(2) Brine curing: Pack the properly cooled meat into a clean barrel and pour over it the prepared brine. For making the brine, take 8 lb. salt, 2 lb. sugar, and 2 oz. saltpetre, and dissolve in 4 gallons of water for every 100 lb. of meat; make overnight and pour in when properly cooled. Small pieces can remain in the brine for six weeks, while larger pieces or hams may stay eight weeks. The barrel should be placed in a cool cellar if possible, or in any other cool place available. Success depends upon getting the animal heat out of the carcase, assuring that the meat is properly cooled and well set before adding the brine.

WEATHER RECORDS : APRIL, 1927.

Dominion Meteorological Office.

GENERAL SUMMARY.

RAINFALL in April was below the average in most parts of the country, and mean temperatures were lower than usual. Cloudy skies were much in evidence in the northern districts, but bright sunshine was above the average in other parts.

High westerly winds were prevalent in the South Island, especially between the 5th and 15th, and from the 22nd to the 26th. The month closed with wintry weather, while a storm area passed slowly to the eastward of the Dominion.

RAINFALL FOR APRIL, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
<i>North Island</i>				
	Inches.		Inches.	Inches.
Kaitaia	6.00	13	2.34	3.55
Russell	4.49	12	1.50	3.90
Whangarei	3.00	13	1.38	4.43
Auckland	3.93	18	0.58	3.46
Hamilton	3.02	17	0.65	3.86
Kawhia	4.00	17	0.66	4.75
New Plymouth	4.52	20	1.15	4.54
Riversdale, Inglewood	5.57	20	0.86	8.39
Eltham	4.14	15	0.67	5.10
Whangamomona	4.13	16	0.65	6.68
Tairua	2.42	8	0.66	5.88
Tauranga	4.36	13	1.51	5.08
Marachako Station, Opoitiki	3.18	9	0.82	4.57
Gisborne	1.77	8	0.39	4.20
Taupo	2.21	8	0.50	3.95
Napier	1.44	13	0.46	2.02
Marackakaho Station, Hastings	1.78	10	0.47	3.14
Taihape	3.78	18	0.86	3.15
Masterton	2.97	12	1.45	3.04
Patea	3.80	15	1.35	3.95
Wanganui	2.02	10	0.50	3.37
Foxton	1.86	9	0.80	2.47
Wellington	1.53	11	0.41	3.80
<i>South Island</i>				
Westport	4.79	20	1.30	6.50
Greymouth	9.37	18	1.80	8.37
Hokitika	9.78	18	2.12	9.38
Ross	12.10	17	2.77	12.55
Arthur's Pass	10.07	15	4.95	16.16
Okuru, Westland	12.00	15	3.18	13.67
Collingwood	6.64	13	1.94	8.07
Nelson	2.02	6	0.92	2.03
Spring Creek, Blenheim	1.16	0	0.85	1.01
Tophouse	3.78	15	0.85	4.22
Hammer Springs	1.13	7	0.43	3.12
Highfield, Waiau	1.00	6	0.30	2.60
Gore Bay	1.82	9	0.50	1.77
Christchurch	1.13	10	0.29	1.07
Timaru	0.84	10	0.22	1.51
Lambrook Station, Fairlie	1.17	4	0.65	1.95
Benmore Station, Clearburn	1.55	7	0.39	2.52
Oamaru	1.60	7	0.58	1.78
Queenstown	3.62	8	0.80	2.02

RAINFALL FOR APRIL, 1927—continued.

Station.				Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
<i>South Island—continued.</i>							
Clyde	..	..	..	1·24	6	0·76	1·34
Dunedin	..	..	..	2·08	11	0·54	2·82
Wendon	..	..	..	1·74	10	0·26	3·36
Gore	..	..	..	2·17	17	0·45	3·29
Invercargill	..	..	..	4·16	23	0·75	4·36
Puysegur Point	..	..	..	11·68	23	1·42	7·98

—D. C. Bates, Director.

FORTHCOMING WINTER SHOWS.

Otago A. and P. Society: Dunedin, 31st May to 3rd June.

Waikato Winter Show Association: Hamilton, 31st May to 4th June.

Manawatu A. and P. Association: Palmerston North, 14th to 18th June.

Rotorua A. and P. Association: Rotorua, 21st to 23rd June.

South Taranaki Winter Show Company: Hawera, 29th June to 6th July.

Wellington Winter Show Association: Wellington, 15th to 30th July.

Auckland Winter Exhibition: Auckland, 21st to 30th July.

Secretaries are invited to supply dates of their shows for publication in this list.

REDUCTION IN PRICE OF STRYCHNINE.

IN connection with the sale of strychnine to settlers for poisoning of rabbits, the Department of Agriculture has reduced the price of alkaloid powdered strychnine (British manufacture) in 1 oz. bottles from 3s. 6d. per ounce to 3s. per ounce. It may be mentioned that an article on Rabbit-poisoning with Strychnine, describing the various baits and methods, was published in the *Journal* for January, 1924, and reprinted in pamphlet form

List of Shows, Exhibitions, &c.—The International Chamber of Commerce, British National Committee, have requested the High Commissioner in London to supply to them a list of agricultural shows, winter shows, exhibitions, fairs, Empire weeks, and other fixtures of a similar nature, to be held in New Zealand during 1928. The information is required as soon as possible for inclusion in the published list of the International Chamber of Commerce this year. The Department of Agriculture has circularized all incorporated agricultural and pastoral associations, also winter show organizations, in the Dominion, requesting the supply of the information to the Department for transmission to London. Any organization in question not reached by this circular is asked to communicate with the Department at Wellington.

Correction.—In the *Journal* for December last, page 396, the true bushel-weight of oats was printed as ranging from 65 lb. to 68 lb.; the figures should have been 35 lb. to 64 lb.

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No. 6.

THE GRASSLANDS OF NEW ZEALAND.

REGRASSING EXPERIMENTS ON DETERIORATED HILL COUNTRY IN WHANGAMOMONA COUNTY

E. BRUCE LEVY, Agrostologist, Biological Laboratory, Wellington.

II. STUDIES ON HOW BEST TO WIN BACK SECONDARY-GROWTH COUNTRY.

THERE are really two main schools of thought in regard to the bringing-back of secondary-growth country. One school claims that crushing with cattle, together with manurial top-dressing wherever this latter practice is possible, is the most economical and direct method. The other holds that it is better and cheaper, eventually, to burn off the secondary growth wherever this is dense enough to carry a fire, sow suitable grass-seed mixtures in the ash, and then maintain by manurial top-dressing the pasture thus formed whenever that practice is applicable. Latterly there has arisen a small school which claims that manurial top-dressing alone will solve the major secondary-growth problems.

The important question to be solved by the research worker—be he a member of some scientific organization or a practical farmer who has been "through the mill"—is how to tackle any area overrun with secondary growth. In the present article of this series I endeavour to outline the different methods that may be adopted, and consider the pros and cons in the light of recent experimental work.

It will be presumed that the country is reasonably well fenced, for, whether one is going to burn, crush, or top-dress, fencing is absolutely prerequisite to the regressing of secondary-growth country. There are then some eight courses open to the farmer:—

- (1) Burning off secondary growth, and sowing suitable grasses and clovers without manure.
- (2) Burning and sowing down suitable grasses and clovers, followed by top-dressing with artificial manures.
- (3) Burning and sowing no seed, trusting to a satisfactory volunteer grass-growth.
- (4) Burning and top-dressing volunteer grass-growth with artificial manures without recourse to further seeding.

These four methods are more or less the practices of the burn-and-sow school, seeding being necessary until the point is reached of having

introduced sufficient grasses and clovers that will volunteer a satisfactory fresh growth after the burn.

(5) Crushing secondary growth with cattle, and trusting to a satisfactory volunteer grass-growth.

(6) Crushing with cattle, accompanied by manurial top-dressing.

(7) Crushing with cattle, accompanied by seeding, with or without manurial top-dressing.

These last three methods belong more to the crushing school. Finally, there is the method of the top-dressing-alone school—

(8) Top-dressing with artificial manures without recourse to burning or seeding.

In the investigation to decide which courses the farmer should take two major questions are kept in view: (1) What is the comparative grassland cover formed after a period of years under each method of treating the country? (2) What is the comparative cost per acre to secure that cover?

(1) Burning and Sowing down with suitable Grasses and Clovers.

If the analyses set out in the accompanying Tables 2, 3, and 4 are considered it will be found that as a result of the seeding alone we have added from 60 up to 80 points of vegetation for every 100 points of the ground-surface examined; in other words, we have covered about two-thirds of the country. Sowing down mixtures recommended in the preceding article (see *Journal* for March last) one can rely on covering about two-thirds of the country by the expenditure of approximately £1 per acre burnt and sown. This is a very satisfactory improvement, and, study the analyses contained in Tables 2 to 5 how we will, we cannot find a greater improvement as far as cover is concerned for any £1 per acre spent on the country in any other way. In the case of analysis No. 5, Table 5, however, where there has been a good 50-point increase in the useful species by the expenditure of £1 per acre on manure, there is little to pick and choose between results. On old, weak turf like this one, still containing fair vestiges of the better species (see analysis No. 4, Table 5), £1 spent on top-dressing is quite an immediately profitable business.

Considering the bare ground recorded in the analyses in Table 3, we find that in No. 1 for every 100 acres burnt and sown on the farm an aggregate of 15 acres is bare and 85 acres is producing feed. In the case of the areas burnt and not sown, and crushed and not sown (Nos. 2 and 3 respectively), approximately only 60 out of every 100 acres are producing feed; in other words, there are 25 acres more of bare ground on the unsown portions than on the sown portions, upon both of which, it must be remembered, £2 an acre has been spent in manurial top-dressing. In the case of the thrice top-dressed area (No. 4), crushed and not sown, 6 acres more per 100 are producing nothing than in the case of the burnt and sown area (No. 1). Again, it will be seen that where three applications of manure were applied there resulted only three-quarters the amount of cover and an increase of 18 points of weeds, compared with the burnt and sown area; while in the case of the two unsown but twice top-dressed areas (Nos. 2 and 3) these were producing at the time of analyses less than one-half the cover of the seeded plot, so far as the useful species are concerned, and from two

and a half to three times as much weed cover. As regards the cost of breaking in, Nos. 1 and 4 have had approximately the same amount per acre spent on them, but the latter has been under treatment a year longer. It might be said also for No. 1 area that the top-dressing of the fern and manuka prior to the burn was largely wasted, although one must admit that seed sown on areas top-dressed prior to the burning does seem to take more readily; one would consider, however, that the manure applied after the burning and seeding would do more good.

It will be noted from Table 4 that the main improvement in the old pasture turf (No. 3) by the £1 spent on manure lies in the great development of the volunteer suckling-clover among the danthonia. Apart, then, from perhaps a general toning-up of the other species, this 35 points of suckling-clover may be regarded as the immediate response due to the top-dressing. In the case of the sown area (No. 1) in the same table the response to the top-dressing has largely been in the promotion of a splendid growth of white clover, together with a healthy stand of brown-top, crested dogtail, and some rye-grass and Lotus major, which combination, in my opinion, has a better feeding-value than the danthonia, Yorkshire fog, sweet vernal, and suckling-clover combination of the old pasture top-dressed. Certainly I would consider that any more money spent in further top-dressing either of these

Table 2.—Analyses of Turfs formed by the Burning-off of Secondary Growth followed by Seeding, with and without Manurial Top-dressing.

Amounts given in table heads as spent on seed or manure are all per acre.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.
Species recorded.	Mixtures 1-6, 1926, 9 months old, £1 on seed.	Mixtures 1-6, 1926, 9 months old, £1 on seed, £1 on manure.	Mixture 2, 1924, 3 years old, £1 on seed, no manure.	Mixture 2, 1924, 3 years old, £1 on seed, £1 on manure.	Mixture 7, 1924, 3 years old, £1 on seed, £2 on manure.	Mixture 2, 1924, 3 years old; £1 on seed, £1 on manure.
	(Coxhead.)	(Gill.)	(Coxhead.)	(Raughan.)	(Coxhead.)	(Barwick.)
Bare ground ..	30 per cent. Points.	15 per cent. Points.	20 per cent. Points	10 per cent. Points.	9 per cent. Points	6 per cent. Points.
Brown-top ..	33	36	32	55	38	48
Crested dogtail ..	20	23	12	9	12	10
Cocksfoot ..	1	3	2	1	4	1
Perennial rye-grass ..	2	5	2	3	3	2
White clover ..	3	5	4	2	1	10
Lotus major ..	0.3	0.3	14	37	34	6
Lotus hispidus ..	1	0.5	2	0.2	2	0.4
Danthonia pilosa ..	1	0.3	8	1	0.5	5
Paspalum ..	Trace		1	6	4	1
Subterranean clover ..	0.2	0.5		1	4	1
Yarrow ..	1	1	1	0.2	1	1
Poa pratensis ..				1	5	4
Chewings fescue ..			2	1	0.5	
Red clover ..					1	1
Suckling-clover ..	4	14	6	3	4	20
Yorkshire fog ..	4	3	6	3	3	5
Catsear ..	3	3	11	4	10	9
Other weeds ..	10	16	5	5	11	16

Summary.

	30 per cent. Points.	15 per cent. Points.	20 per cent. Points.	10 per cent. Points.	9 per cent. Points.	6 per cent. Points.
Bare ground ..	62	75	80	116	101	85
Useful species introduced by seeding						
Useful volunteers ..	8	17	12	7	16	30
Weeds ..	13	19	16	9	21	25
Total points ..	83	111	108	132	138	140

two turfs would be more profitably spent on keeping the sown portion going strongly.

From a further study of these tables, if one compares the swards derived from the various methods employed, it is seen that a good range of species is secured from the burning and seeding, so that, whatever the pasture management, one species or more is established to meet any change in the habitat that may arise. If top-dressing can be systematically carried out there are present on the sown country species that are capable of big response; on the other hand, if top-dressing is not practicable, then the danthonia established as a result of the seeding is there to carry on after the fertility contained in the ash of the burn has become depleted. Compare, for example, the analysis No. 1 in Table 3 with Nos. 2, 3, and 4. In No. 1, under top-dressing, all the better species are present in sufficient quantities to make really first-class pasture, whereas in Nos. 2, 3, and 4 the only species that has established itself in sufficient quantity to do much good is the white clover; and with these plots it is a case of continual top-dressing, or rapid deterioration will again soon set in. In No. 1, *Lotus major*, an important species to get going throughout secondary growth, is well established, whereas there is none in the other three plots. Again, after eighteen months, 3 points of danthonia are recorded

Table 3.—Analyses of Turfs formed by different Methods of breaking in Country.

All plots except No. 5 situated in same paddock; No. 5 on similar type of country

Species recorded.	No. 1. Burnt and sown 1925, mixture 6; 3 cwt. slag prior to burn, and 3 cwt. after seed sown; £3 per acre spent.	No. 2. Burnt 1925; no seed sown; same top- dressing as No. 1, £2 per acre spent.	No. 3 Not burnt or sown, but crushed out; same top- dressing as Nos. 1 and 2; £2 per acre spent.	No. 4. Not burnt or sown, but crushed out; top-dressed three times with 3 cwt. slag; £3 per acre spent.	No. 5. Burnt and sown 1925, mixture 4; no top- dressing; £1 per acre spent.
Bare ground	15 per cent. Points	43 per cent. Points	39 per cent. Points.	21 per cent. Points.	20 per cent. Points.
Brown-top	22	..	0.2	1	34
Crested dogstail	11	..	..	3	9
Cocksfoot ..	5	4	3	11	0.4
Perennial rye-grass	7	1	..	1	5
White clover	38	17	19	23	7
Lotus major	13	..	..	..	4
Lotus hispidus	0.4	..	..	..	0.4
Paspalum ..	..	..	..	..	2
Danthonia pilosa	7	..	0.2	..	20
Subterranean clover	0.2	..	..	..	..
Yarrow	1	0.1	0.1	3	2
Suckling-clover	6	14	2	8	0.2
Yorkshire fog	1	5	4	22	1
N.Z. rice-grass	0.2	2	11	2	..
Catsear ..	2	11	5	10	4
Cudweed ..	2	2	0	1	2
Hawkweed ..	2	5	6	5	2
Other weeds	4	6	13	12	..
Other grasses	0.4	1	2	0.2	..
Other clovers	1	1	0.4	0.4	..
Summary.					
Bare ground ..	15 per cent. Points.	43 per cent. Points.	39 per cent. Points.	21 per cent. Points.	20 per cent. Points.
Useful species intro- duced by seeding	101	..	..	..	84
Useful volunteers ..	8	45	42	75	1
Weeds ..	10	22	33	28	14
Total points ..	119	67	75	103	99

NOTE.—Analysis No. 5 done 22nd February, 1927—three months later than Nos. 1-4.

in the sown and manured plot, and on the sown and not-manured plot after twenty-three months 20 points of danthonia are recorded; whereas in the other three plots not sown there is but a trace in one of them, and this after three to four years' crushing. The establishment of danthonia is the best guarantee against deterioration in any hill country that cannot be top-dressed, and may be considered as one of the major questions throughout the more difficult Taranaki back-country. Burning and seeding of the burn does enable a fairly rapid establishment of this grass to take place.

If we examine the analyses in Table 4, and compare No. 1 with No. 2, the evidence in favour of sowing is overwhelming. Both these plots have been top-dressed since the secondary growth was burnt off, and there are shown to be 83 points of useful vegetation on the burnt and sown portion, as against only 18 points of useful volunteers on the burnt and unsown portion.

In dealing, then, with the first question—whether one should burn and sow—in my opinion the answer must be in the affirmative for the general run of the hill country. Farmers starting to break in secondary-growth country should burn as late in autumn as possible, and sow immediately one or other of the seed mixtures recommended on page 162 of the *March Journal*. Exceptions, where seeding after the burn is not advisable, are dealt with later in the present article.

Table 4.—Analyses of Turfs formed by Burning, Seeding, and Top-dressing, compared with Burning and Top-dressing without Seeding.

All plots in same paddock, but No. 4 on a different aspect.

Species recorded.	No. 1. Burnt and seed sown 1926, mixture 3; top- dressed 1926, 3 cwt. slag, £2 per acre spent.	No. 2. Burnt but not seeded; top- dressed as No. 1; £1 per acre spent.	No. 3. Old turf adja- cent to Nos. 1 and 2; same top-dressing; £1 per acre spent.	No. 4. Burnt but not sown, 1925; 3 cwt. slag 1925; 3 cwt. basic super. 1926, £2 per acre spent.
Bare ground	18 per cent. Points.	43 per cent Points.	14 per cent. Points	26 per cent. Points
Brown-top	18			
Crested dogstail	14			
Cocksfoot	1	2	1	
Perennial rye-grass ..	3			
White clover	33	1		1
Lotus major	2			
Danthonia pilosa .. .	1	1	43	23
Suckling-clover	8	3	35	26
Yorkshire fog	3	11	10	8
Sweet vernal	4	16	10	13
Hairgrass	1	1	0.4	8
Catsear	9	7	17	7
Cudweed	1	8	2	1
Hawkweed	3	8	1	1
Other weeds	4	8	11	15
Other grasses	0.2			2
Other clovers	0.6			
Summary.				
Bare ground	18 per cent. Points.	43 per cent Points.	14 per cent. Points.	26 per cent. Points
Useful species introduced by seeding ..	72			
Useful volunteers	12	18	82	58
Weeds	22	48	41	47
Total points	106	66	123	105

Table 5.—Analyses showing the varying Responses by Manurial Top-dressing on Two different Classes of Old, Run-out Pastures.

Species recorded.	Danthonia dominant, following on Years of Crushing.			Weak, Worn-out Pasture Remnant of the Old Sown Turf.		
	No. 2. Before top-dressing.	No. 2. First year after top-dressing; £1 per acre spent.	No. 3. Second year and after second top-dressing; £2 per acre spent.	No. 4. Before top-dressing.	No. 5. First year after top-dressing; £1 per acre spent.	No. 6. Second year and after second top-dressing; £2 per acre spent.
Bare ground ..	22 per cent. Points.	22 per cent. Points.	14 per cent. Points.	20 per cent. Points.	8 per cent. Points.	6 per cent. Points.
Cocksfoot ..	3	4	3	8	5	7
Crested dogstail ..	..	..	..	..	1	1
Perennial rye-grass ..	0.3	..	..	3	3	6
White clover ..	..	..	2	3	34	58
Suckling-clover ..	1	5	23	3	23	22
Red clover ..	..	..	0.3	..	1	1
Lotus major ..	..	..	..	0.3	0.3	1
Timothy ..	..	..	..	..	..	1
Poa pratensis ..	2	0.3	..	3	7	5
Danthonia pilosa ..	47	54	49	1	..	0.3
Yorkshire fog ..	6	8	9	9	7	13
Sweet vernal ..	10	11	14	16	20	21
Catsear ..	16	9	18	27	17	13
Rib-grass ..	1	1	1	2	6	9
Cudweed ..	1	..	0.6	6	6	3
Selfheal ..	2	3	0.3	8	3	2
Other weeds ..	8	..	7	4	5	3
Summary.						
Bare ground ..	22 per cent. Points.	22 per cent. Points.	14 per cent. Points.	20 per cent. Points.	8 per cent. Points.	6 per cent. Points.
Useful species ..	59	71	86	30	81	115
Weeds ..	47	24	41	61	57	51
Total points	106	95	127	93	138	166

(2) Burning and Sowing with suitable Grasses and Clovers, followed by Top-dressing with Artificial Manures.

Burning and seeding alone involves the ability to crush. It is therefore the practice of the larger landholder, who has at his disposal all the hoof-power that is required. The plan of the smaller holder, who cannot afford to crush so hard on account of the cattle losses, lies more in the promotion of a greater amount of more palatable feed on a given area, so that he can hold the necessary stock there to deal with re-appearing fern, &c., without the forcing necessary on areas where feed is more scanty and less palatable. This brings up the second question, Should the country be top-dressed with artificial manures after burning and seeding?

The question of top-dressing the burn immediately following the seeding and subsequently is a very big one. There is so much country that is quite inaccessible to the top-dresser that to affirm the essentiality of all areas burnt and sown being also top-dressed must needs exclude the hope of many large areas ever being tackled. My firm conviction in regard to this regrassing work is this, that if one can only keep secondary-growth country open to the light by burning or by crushing for a period of from five to ten years, *Danthonia pilosa*, provided it is introduced early in the process, will grass that country, and the more rapidly *danthonia* can become established the quicker will the grassing of the country become. The initial burning of the secondary growth

and the sowing-down of the burn afford an initial opportunity for getting this grass established, and that opportunity should on no account be lost.

Now, there are always on these farms closer and more accessible portions, and the question here is whether one should be satisfied with the danthonia turf or aim at a combination of better species. With a reasonable amount of top-dressing following the seeding one can rely on retaining a good turf of brown-top, crested dogstail, Lotus major, and white clover, with a small proportion of rye-grass, cocksfoot, and Poa pratensis; and here is where top-dressing plays a part. The objective should be to top-dress after burning and seeding all of the easier and more accessible country, so as to maintain the sward of brown-top, crested dogstail, Lotus major, &c., and to get danthonia established by the cheapest and quickest method possible on the higher and more inaccessible and poorer parts of the farm. Suppose one does get danthonia dominant over the greater part of the farm, and then finds that one can extend the top-dressing, in my opinion it would be far better to spend money on top-dressing a danthonia-dominant sward, even though the immediate response might not be great, rather than spend the money on top-dressing weeds, bare ground, and secondary growth.

It is rather difficult to decide from the analyses whether, if a farmer had, say, £50 to spend, it would be better to burn and sow, say, 50 acres of secondary-growth country and use the money on seed alone, or to burn 25 acres and spend £25 on seed and £25 on manure. Comparing analyses Nos. 1 and 2, Table 2, one sees that for every 100 acres burnt and sown 15 acres more is covered by pasture on the top-dressed area, and taking into consideration all the vegetation there is an increase of approximately one-third. The species sown have increased by 12 points per 100, and the volunteer useful species have doubled, the increase being due to the greater growth of suckling-clover. Then, again, it must be borne in mind that if one can make 1 acre produce what 2 acres do normally one is more than doubling the net income from that area, for there is interest, rates, maintenance, costs, &c., to be paid only on 1 acre instead of 2. Further, the effect of the top-dressing may well be expected to last for at least three years, so that if the increase of vegetation each year is anything like one-third increase over the un-topdressed portion, then the top-dressing must be regarded as being a payable proposition.

Further, if one compares the three-year-old turfs—Nos. 3, 4, and 5, Table 2—it will be seen again that roughly there is an increase of one-third in the number of points recorded. In the one case the increase was largely in the species sown, and in the other mainly in the useful volunteers, suckling-clover contributing the greater part. This difference in response by the different species is largely due to the farm-management. Nos. 3, 4, and 5 have been rotationally grazed, and never at any time have these areas been closely and continuously grazed for long periods. In the case of No. 6, close and continuous grazing has been carried on during the three years that these plots have been in existence. The varying response by certain species in particular is interesting under the two systems. Spelling for a period coupled with top-dressing stimulates greatly the development of Lotus major, which when allowed to get away rank suppresses greatly the white clover and the suckling-clover. The close grazing checks the Lotus-major development and encourages the development of white clover and suckling-

clover, provided top-dressing is being done. This is well seen in these analyses. The close and continuous grazing also increases more rapidly the development of danthonia. While deprecating generally close and continuous grazing, one has little objection to raise in the case of turf No. 6, for the 36 points of white clover, *Lotus major*, and suckling-clover make a very nicely balanced ration—better, one would think, than the more dominant *Lotus major* of the other plots. It is a point that needs careful study, and from these figures it would appear that it is better to control the *Lotus-major* development somewhat by heavier stocking, so that the white clover and the suckling-clover may not be smothered out by the rank growth of which *Lotus major* is capable when top-dressed.

There is no doubt that these top-dressed plots are very good, and the low percentage of bare ground testifies to the splendid cover secured on them. If only it were practicable for all secondary growth to be burnt, seeded, and top-dressed the troubles connected with it would be largely at an end.

As regards the small holder, I can see very little hope of his country being broken in except he overfences to an unprofitable degree—unless he top-dresses every acre burnt and sown. For the small holder top-dressing after burning and seeding means control of reappearing secondary growth without the cattle losses that must inevitably follow forced crushing. With the larger holding, as before stated, the position is quite different. The holder can burn and sow in big blocks; he can hold and crush in large paddocks; and he can afford to produce less per acre and to wait longer for the necessary development of the hardier grasses that make for the ultimate cheaper working of the country. I am not prepared to say that the small holder cannot make a good living off hill country, but his method of tackling the land must conform to fairly definite principles, whereas the large holder can take many more liberties with the country—provided always he has the necessary stock and equipment to manage a large holding. Large holdings inefficiently equipped will, of course, deteriorate even more quickly than will the small holding. I have referred to this matter here because I believe it draws a very definite line between those areas that can only satisfactorily be brought back by burning, seeding, and manuring, as against those that may be brought back by seeding only followed by crushing, or even by crushing alone.

(3) Burning and Sowing no Seed, trusting to a Satisfactory Volunteer Grass-growth.

While recommending in general the sowing of all burns at the present time in the Taranaki back-country so as to introduce species suitable to that country, the final objective is to be able to burn off any secondary growth or crush it out and get a volunteer return grass-growth of suitable species, in order that ultimately very little more seed, if any, need be sown. The species most useful in this respect are *Danthonia pilosa*, brown-top, *Lotus major*, *Poa pratensis*, suckling-clover, Yorkshire fog, and, on the sunny aspects and warmer country, *paspalum*. Suckling-clover and Yorkshire fog are already sufficiently well established, and danthonia is now making headway, but its progress is slow. Brown-top, *Lotus major*, and *paspalum* are the three less common species. Once these species are well established among any

secondary growth or immediately adjacent to it, then the seed-bag can be withheld; but until then every effort should be made to get one or other, or all, truly established on the area. Just which ones will ultimately persist depends largely on the farm-management, particularly in regard to top-dressing and stocking.

With regard to this method of establishing on the country species that will volunteer to return once the shade of the secondary growth is removed by burning or crushing, the analysis shown for plot 4, Table 4, is interesting, and will serve to make clearer the ultimate aim. The hard-fern patches on which the analysis was made were burnt in 1925. They are situated on a hard sunny face where danthonia is dominant up to the edge of the hard-fern patch, and some danthonia was even persisting or lingering in the hard fern itself. These patches were burnt and not sown, so as to study the volunteer return growth. The danthonia recorded is largely from the original plants that were lingering in the hard-fern cover. With the letting-in of the light these plants almost immediately took on a stronger growth, and an examination of the bare ground in December, 1926, showed numerous danthonia-seedlings established; in fact, more young plants per acre were established as volunteers from seed shed than could have been secured from the artificial sowing of some 10 lb. or more per acre. With these patches now it is only a matter of keeping the turf open to the light by further burning or crushing and the country will be grassed. The amount of 26 points of suckling-clover on this area is also volunteer growth, and is due almost entirely to the top-dressing.

From the foregoing it will be seen that the answer to the third question, whether to burn and trust to a satisfactory volunteer grass-growth, depends largely on whether there are any satisfactory plants lingering on the area that will respond as volunteers.

In No. 2, Table 3, and in No. 2, Table 4, the analyses show a poor volunteer growth considering that these plots have been top-dressed, and in both these instances I certainly would recommend that seeding should follow burns of such nature. In the case of plot 4, Table 4, the treatment will ultimately give a complete cover of volunteer danthonia; but in this case, where top-dressing is being carried out, I would have advised the sowing of some seed of brown-top, crested dogstail, Lotus major, and white clover. Without top-dressing, however, when one sees danthonia as a dominant throughout the country, and where stunted sweet vernal and hair-grass come away as volunteers along with the danthonia after the burn, one must admit that to sow seed of any species on such country is decidedly wasteful unless top-dressing can be carried out. Here, again, to top-dress the poorer country first in the hope of getting something a little better than danthonia is not good business while there are other areas on the farm that would better repay the money spent on top-dressing them. For example, £2 spent in top-dressing on this turf (No. 4, Table 4) resulted only in an increase of some 27 points, most of which is suckling-clover. Compare also in this respect the responses secured from top-dressing the two areas shown in analyses Nos. 2 and 3 and 5 and 6, Table 5. Unquestionably the poorer and harder country gives the least response, both in the matter of seeding and of top-dressing; and there is a line somewhere in soil-qualities below which it does not pay to top-dress or to sow seed after secondary burns. In these cases hardy grasses like danthonia or ratstail, established by the cheapest possible means, should be the objective.

(4) Burning, and Top-dressing Volunteer Grass-growth with Artificial Manures.

The only condition under which one would recommend the top-dressing of secondary-burn country without seeding is, as indicated in the heading, when there is a good volunteer growth of permanent grasses and clovers. Referring again, for example, to analysis No. 2, Table 4, where 3 cwt. of slag per acre has been applied, it will be seen that nearly half the area is bare ground from which there is no response, and of the remaining half two-thirds consists of weeds and one-third of second-rate grasses, mainly Yorkshire fog. Does this response justify the expenditure of £1 per acre in top-dressing? In the case of No. 4, Table 4, there certainly is some justification for the top-dressing, although, as before stated, it is very doubtful if the money used for the top-dressing was well spent.

Top-dressing after secondary burns, without seeding, is justified only when the volunteer growth consists of species that can respond. Brown-top, Lotus major, paspalum, and suckling-clover come well within this category, and I would unhesitatingly recommend the top-dressing of such volunteer growth. In the case, however, of danthonia, weak Yorkshire fog, stunted sweet vernal, hair-grass, and sparse suckling-clover, top-dressing is very problematical, to commence with at any rate, while the top-dressing of virtually no sole at all must be absolutely unsound. Top-dressing can only promote—it cannot create.

It will therefore be seen that I advocate leaving the hardest and poorest country severely alone, as far as spending money directly on it is concerned, until such time as the better portions of the farm are producing their maximum. Then, with money derived from the greater returns of the better country as a result of the top-dressing, a start may be made towards improving the poorer land. If top-dressing is found not to return a profit on the better portions of the farm it certainly will not do so on the poorest.

(5) Crushing Secondary Growth with Cattle and trusting to a Satisfactory Volunteer Grass-growth.

Is it advisable to crush with cattle and trust to a satisfactory volunteer grass-growth? At the present time—in the Taranaki back-country at least—crushing with cattle leads to hard fern. Most of the country now in bracken, manuka, &c., has been more or less through the hard-fern stage, and throughout such country there still linger remnants of this troublesome growth. Hard fern lingers in just the same way as does danthonia, brown-top, Lotus major, or paspalum, and as soon as the shade of the taller secondary growth is removed by the slashhook or by the crushing of cattle hard fern at once becomes strong and vigorous again; and, owing to the fact that there is little or no competition from any turf sown, its spread over the bared ground is very rapid. I have seen areas bared of secondary growth almost completely covered with hard fern within three years of being crushed out. The rhizome of these hard-fern remnants are right on the ground-surface, and a hot fire which can be secured before any crushing has been done kills these old plants outright. Although there is still sporeling infection to contend with after the burn, yet, provided grass-seed is sown, quite a good sward may be formed before these plants develop to any size. Hard fern is an exceptionally good example of an undesirable volunteer, and it is induced very largely by crushing.

Where one has the hoof-power to crush rapidly the hard-fern remnants may be largely destroyed, but when crushed slowly, little by little, there is nothing surer than a hard-fern association making a reappearance.

The crushing of bracken on country where hard fern does not make its appearance—usually country with under 60 in. of rainfall—or on poor, light country, is an entirely different matter. Thousands of acres of bracken-fern country have been converted into danthonia country or brown-top country by the mere crushing with cattle. It can be equally well said that thousands of acres of similar secondary growth have been also converted to danthonia or brown-top by the repeated burning-off of the bracken without a hoof of cattle being employed.

Successful crushing with cattle without recourse to burning or seeding is, as before mentioned, confined almost entirely to the large holding where the loss of a few hundred head of cattle is regarded as the price paid to clean the country. The small holder also often attempts to crush, and over the easier portions of the farm this may be fairly successful; but when it comes to really forcing the cattle on to the more difficult portions the small man either has not the necessary number of cattle or he cannot bear the financial losses that occur as soon as cattle are really forced.

Fencing into small paddocks, of course, enables the small holder to crush, but at the present time we know very little of the economics of fencing hill country into paddocks sufficiently small for this purpose. No doubt the adherents of the crushing school have plenty of backing from their successes in the past, but in many cases I firmly believe that had the country been burnt and sown prior to the crushing there would have been considerably less loss in cattle and a better mixed-pasture sward would have resulted.

Even when areas are burnt and sown, crushing to some extent is still necessary, and the ability to crush or to hold the country is the deciding factor between success and failure. A dense return of secondary growth will kill all pasture species sown, particularly if it comes back before these get well established. Here, again, the large holder with his hundreds of cattle has the problem as it were in the hollow of his hand. Not so the small holder, to whom the loss of one cattle-beast may be regarded as a misfortune. The power to crush and to crush at the right moment is indispensable for the economic breaking-in of secondary-growth country.

If the present discussion seems to give hope for the successful regrassing of most of the hill country of the type here dealt with, I must nevertheless stress the futility of spending any money on sowing burns unless the farmer is confident that he has the necessary power, either in the form of cattle for crushing, or in the form of manures for stimulating increased feed with which to maintain more stock per acre on the slopes burnt and sown. Many a good effort will end in nought unless this provision is made beforehand. The same applies also in the matter of fencing.

One of the great disadvantages of crushing without sowing is that it does not allow of control or selection of the pasture species. It is all a matter of chance, and, until danthonia comes in, bare ground, weeds, and inferior grasses are usually dominant. Yorkshire fog, sweet vernal, catsear, hawkweed, and cudweed are usually the first fruits of crushing.

Clovers appear in quantities only if the soil is fertile or if top-dressing is being carried out. If there was a certain amount of danthonia lingering in the secondary growth before crushing, this volunteers fresh growth, the plants by reseedling and vegetative spread gradually thicken up the turf, and in from six to ten years danthonia becomes almost universally dominant, bearing out that if only light can be admitted to the ground-surface this grass will ultimately come in and take charge.

From six to ten years, however, is a long time to wait, and during this period crushing has to be faithfully carried on, whereas in the case of burning and sowing and manuring the same number of stock can be maintained on the area sown without so much forcing and without the subsequent losses by death. This is where burning and sowing and subsequent top-dressing may be regarded as all to the benefit of the small holder. He can do his work better, he can get immediate return, and can control secondary growth by providing enough feed to keep a sufficiency of stock working without undue forcing.

Again, in a wet climate like that of the Taranaki back-country, unless some danthonia is sown or otherwise introduced, it may be considerably over ten years before a good danthonia sward is formed, and one naturally asks what is going to cover the ground in the meantime. This can be very largely answered by referring to analyses shown in Table 3. In the case of No. 3, had this area not been top-dressed the white clover and suckling-clover most certainly would have been absent, which would have left some 21 per 100 points examined of useful vegetation, consisting of New Zealand rice-grass and Yorkshire fog. Danthonia is just making its appearance, and it will be a matter of from six to ten years' work crushing this area before the sward of danthonia and rice-grass ultimately takes charge. In the case of plot 4, which has been crushed for four years, if one takes out the clover, the increase of which is entirely due to the top-dressing, there remains some 44 points of useful volunteers, mainly Yorkshire fog (22 points) and cocksfoot (11 points), most of this latter increase and a good deal also of that of the Yorkshire fog being due to the top-dressing.

In cases where there are obviously good species lingering among the secondary growth, particularly cocksfoot, then crushing undoubtedly is preferable to burning; and where such species as brown-top, Lotus major, paspalum, and danthonia are obviously well scattered throughout the secondary growth it matters not whether the area is crushed out or burned, for any of these will carry a fire well, whereas cocksfoot does not do so.

Another point in crushing as compared with burning is that such growth as manuka is more effectively dealt with by burning. On plots 3 and 4, Table 3, quite a large amount of manuka was making its appearance, both from plants that were too small to cut at time of clearing and from the base of the smaller cut bushes. In plots 1 and 2, that were burnt, no living manuka is present. At the time of my last visit pulling of this reappearing manuka had commenced on the unburnt but crushed plots, which would soon put another £1 per acre on to the breaking-in cost. What has been said in the foregoing remarks regarding burning *versus* crushing holds good only while the destruction of secondary growth remains the main objective. Once the grass sward is formed any roughage in this should be cleaned up by cattle in preference to burning it off.

(6) Crushing followed by Top-dressing.

Referring again to the analyses 3 and 4, Table 3, some idea can be obtained of the effect of top-dressing after crushing on this particular class of country. In these plots, if one puts down the clover increase as the immediate effect of the top-dressing, it is found that by the expenditure of approximately £2 and £3 per acre respectively the vegetation on these plots has been increased by 21 points in the first case and 31 points in the second. No doubt in the second case also the 11 points of cocksfoot and a certain increase in the Yorkshire fog have been largely due to the top-dressing. These are the bare facts, and, although the piece of ground on which these trials were conducted happens to be some of the poorest in the district, the results do not justify confidence in the top-dressing of any dense secondary-growth country in conjunction with crushing. After all, is it reasonable to spend valuable time and money top-dressing virtually bare ground and inferior vegetation in the hope that one day some more useful plants will ultimately put in their appearance? Where there exists within the secondary growth a sufficiency of suitable grasses and clovers that are capable of responding immediately to the top-dressing, then, of course, one may look forward confidently to a payable return from top-dressing in conjunction with crushing. But in dealing with dense secondary growth, if one is in a position to manure, my firm conviction is that such growth, wherever it is dense enough to carry a fire, should be burnt and sown prior to the manuring.

There is no doubt that top-dressing is a vital factor in production—perhaps the greatest single factor in production at the present time; but, owing to its varying responses when applied to various classes of soil, care must be exercised to ensure that the money is spent to the very best advantage. "Top-dress the best country first" is an axiom for all top-dressers. The truth of this axiom may be seen from an examination of the analyses given in Table 5. These are made on two areas that have been top-dressed twice, using 3 cwt. basic slag per acre each time. Analyses 1, 2, and 3 are on a danthonia-dominant sward which has been derived largely by constant crushing during the early years of the breaking-in of this country. Analyses 4, 5, and 6 are taken on a weak, worn-out pasture remnant of the old sown turf, but where apparently depletion of fertility had not gone so far as in the case of the danthonia-dominant sward; this state is indicated by the percentage of the better elements showing in the pasture, as seen in analysis No. 4, done prior to the first application of manure. On each of these two areas approximately £2 per acre has been spent, and if one takes the clover increase as representing the major response of the top-dressing it will be seen that in the one case this has increased by 24 points in two years, and in the other case the increase has been 76 points, or approximately a response three times greater. In the one case it took two applications to get 23 points of suckling-clover, and in the other only one application to get the same response. In the case of white clover it would appear that two applications of manure on the danthonia-dominant area were required to bring this up to the state of the second area before any manure was applied. The two applications on the second area increased the white clover by 55 points. As far as the other constituents of the sward are concerned, apart from a general

toning-up reflected in the much greater palatability of the pasture, there seems to have been little change up to the present. Just what effect this vigorous growth will have on the other species is a matter for further study.

(7) Crushing followed by Seeding.

Does it pay to spend money on seed in the effort to thicken up weak, old turfs? The thickening-up of weak turfs—that are so characteristic of country newly crushed out of secondary growth, and of old worn-out pastures where unsuitable species have been sown—by the surface-sowing of more seed of grasses and clovers has been tested fairly extensively at Whangamomona, and almost without exception it can be said that the sowings have been an utter failure. In my opinion no money should ever be spent in surface-sowing on weak turf—at any rate not by the impecunious who need rapid return for money expended—unless the surface can be stirred to some extent and liberally top-dressed with artificial manure.

One application of manure on the general run of hill-country turf is of little value in aiding establishment, and by the time two or three applications have been made the growth of suckling-clover and other such plants has so increased as to cover the ground, which again adds to the difficulty of any other seed establishing itself.

On any area of weak turf sown one can find odd plants of *paspalum*, crested dogstail, subterranean clover, brown-top, rye-grass, and *danthonia*; but the general effect of these, for the first three years at least, in thickening up the turf is virtually nil, and the practice must be considered uneconomical. In examining the turfs in a general way one would say that crested dogstail was about the best establisher in weak, open ones, but, as will be seen from the analyses given in Table 6, very little added cover has been secured from a very heavy experimental sowing of this seed.

Table 6.—Showing attempted Introduction of Crested Dogstail into a Weak Turf by Surface-sowing of Seed.

Crested dogstail sown 1926 at the rate of 20 lb of seed per acre. Analyses made four months after seeding.

Species recorded.	Plot 1. Not top-dressed at Time of Seeding.		Plot 2. Top-dressed with 1 cwt. S per. at Time of Seeding.	
Bare ground	13 per cent.		19 per cent.	
Crested dogstail	0.4 points		..	
Brown-top	19 "		7 points	
Cocksfoot	18 "		18 "	
<i>Danthonia pilosa</i>	13 "		20 "	
Yorkshire fog	19 "		21 "	
Perennial rye-grass	6 "		7 "	
Catsear	6 "		6 "	
<i>Poa pratensis</i>	4 "		7 "	
Piripiri	7 "		1 "	
Hawkweed	7 "		5 "	
Other grasses	1 "		0 "	
Suckling-clover	0.4 "		0 "	
Other weeds	10 "		11 "	

This is a record of establishment only, and it will be seen that on the old turf crested dogstail has completely failed. In one-, two-, and three-year-old surface-sowings of weak turfs there has been virtually no improvement effected. For the time being, at any rate, no money should be spent on seed for the thickening-up of weak, worn-out turfs, nor for turfs formed after the crushing-out of secondary growth. The one golden opportunity of getting a good sward established satisfactorily lies in the ash of the burn.

(8) Top-dressing without Burning or Seeding.

It is claimed that such top-dressing renders what feed there is within or immediately surrounding the secondary growth so much more plentiful and palatable that stock are drawn on to the top-dressed portions and held there in sufficient numbers to control the secondary growth without recourse to the force that is implied and applied in the crush method.

Where there is weak secondary growth with a fair amount of grass persisting among it, and where it is impossible to get a fire to travel through the growth, then the application of manurial top-dressing may be perfectly sound; but to top-dress any sort of dense secondary growth is, in my opinion, absolutely futile and an economic waste. Particularly is this true of dense bracken fern, hard fern, or manuka, and other scrub that has been felled and not burnt. Top-dressing grassed portions between masses of this growth may be perfectly sound, but to give the secondary-growth patches a double dose, as is so often done, is, in my opinion, foolish. In this experimental work I have studied patches of hard fern, &c., that have had two and three applications of manure, and by no stretch of imagination could one say that from £2 to £3 an acre improvement had been effected. Grassed patches between clumps of secondary growth were certainly showing a marked improvement from the top-dressing, but not so the hard fern and other secondary growth itself. It must be remembered that in top-dressing one is spending hard cash, and to throw that away indiscriminately is economic suicide. If a farmer is in a position to top-dress a paddock he should first burn and sow these clumps of secondary growth, and then every pound of manure applied will have some useful vegetation to feed.

Conclusion.

I have here endeavoured to outline and to show by carefully made analyses the general trend of the development of this experimental work and some tentative conclusions regarding it. The measuring of results of experimental sowings, top-dressing trials, &c., and the weighing-up of all the factors operative in the developmental phases connected with the regrassing of the deteriorated country must necessarily take time. I feel confident, however, that by carefully recording, year by year, each step in that development—be it retrograde or forward—ultimately it will be lack of application rather than lack of knowledge if the country is not successfully and economically grassed.

My thanks are due to the Director of the Fields Division, Mr. A. H. Cockayne, for guidance in this work generally. Credit in connection with the botanical point analyses accompanying this article is freely given to my assistant, Mr. E. A. Madden.

THE BLACKBERRY PEST.

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I. BIOLOGY OF THE PLANT.

BLACKBERRY is a member of the family Rosaceae, which includes one hundred genera and two thousand species, to which belong most of our fruits of economic importance. Blackberry itself belongs to the genus *Rubus*, a cosmopolitan genus comprising two hundred and twenty-five species, occurring most abundantly in the North Temperate Zone. In the British Isles alone there are over forty species and varieties of this genus; New Zealand has only four native species and three varieties, making a total of seven. Belonging to the same genus and closely allied to blackberry are loganberry, raspberry, &c.



FIG. 1. RUBUS FRUTICOSUS LINN.

[Photo by H. Drake

INTRODUCED SPECIES.

Into New Zealand there have been introduced two main types of blackberry—namely, *Rubus fruticosus* Linn. and *Rubus laciniatus* Willd. The first (Figs. 1 and 2) is a very variable plant, and is found growing abundantly in many parts of New Zealand, having been originally introduced by the early missionaries. The second (Fig. 3) is not nearly so widespread; it is most abundant in the Wellington and Wairarapa districts, though also occurring in Manawatu and Taranaki, and to a less extent in Auckland and Poverty Bay; but nowhere is it as abundant as *R. fruticosus*.

The size and the extent of the bushes vary very considerably in different districts throughout New Zealand, and in different situations

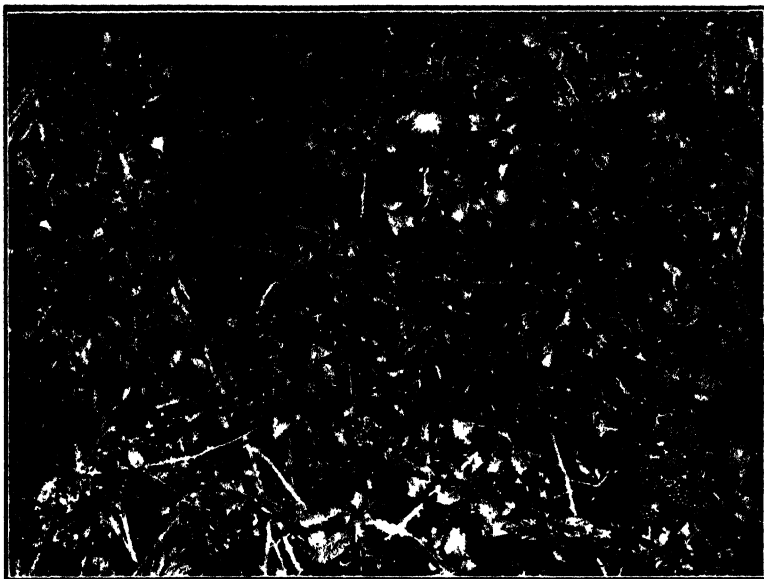


FIG. 2. PORTION OF FRUITING BUSH OF RUBUS FRUTICOSUS

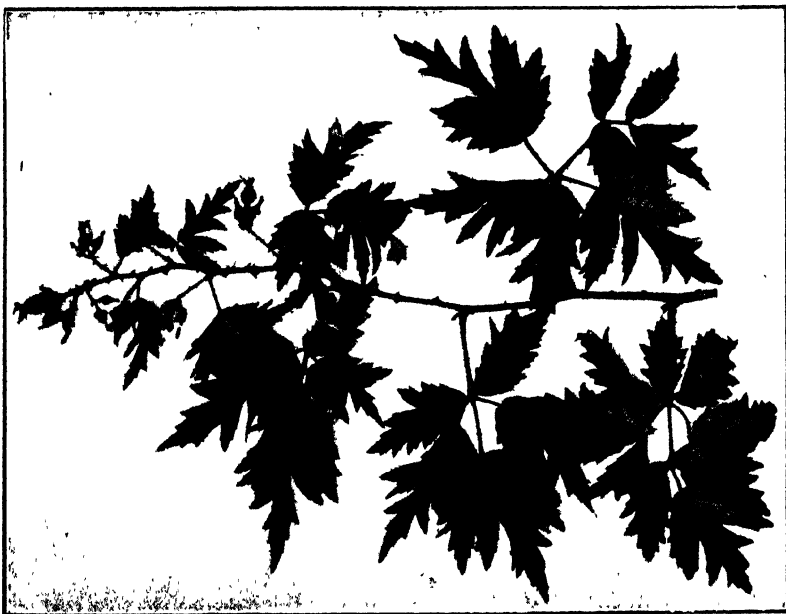


FIG. 3. RUBUS LACINIATUS WILLD.

[Photos by E. F. Northcroft

in the same district. Even on the same hillside local variations very considerable in extent occur. One large bush, unfortunately, is not the result of growth from a single crown which becomes larger the older the bush becomes; it is made up of several large crowns and very many small ones, together with numerous rooted stems. This condition, besides more than doubling the labour required to clear the land by the usual method of cutting the plant, makes the problem of treatment in any experimental work towards eradication or control far more difficult. (Fig. 4.)

MEANS OF DISTRIBUTION.

Flowers are produced terminally on the long main shoots, or on the short lateral shoots, in very great abundance. Flowering takes place towards the end of November or the beginning of December, the fruit being ripe about the beginning of March; but these times vary considerably each year in different localities. The several means of distribution of the plant are as follows:—

(1) *Seed.*

The edibility of the fruit is the main cause of the great and wide spread of the weed throughout the country. The fresh seed (Fig. 5) does not germinate readily, but it has much greater powers of germination after being acted upon by the gastric juices. Birds are the principal agents in this case, though it is very noticeable how abundant the plant has become round old camps and along roadsides where gangs of roadmen have been employed. However, there is no doubt that birds are responsible for the spread of the weed in the hill country of New Zealand, and also for its frequent appearance immediately after a good bush-fire. It is quite a usual thing to find a number of young plants growing in the tops of old stumps, or even high up in the fork of a tree, where there is any decaying matter. Birds must have deposited the seed in such situations. Also there is no doubt that the frequent occurrence of blackberry-bushes along so many of our fence-lines while the land on either side is clear is due to carriage by birds.

(2) *Rooting-stems.*

Another method of spread is by means of rooting-stems, which are produced by the parent bush. Towards the end of summer many of the long vines which were produced in the spring commence to grow downwards, becoming greatly elongated. Tracing these stems from the bush towards the growing point it is seen that there is a very noticeable reduction in size and change in form of the leaves, which gradually become more and more reduced until ultimately they become represented by scales. Morphologically these stems represent greatly elongated growing-regions. Other long shoots, which commence their development in the late summer, come from the centre of the bush and grow out along the ground. These in appearance are exactly the same as those already described. The ends of these shoots either lie closely appressed to the surface of the ground, or, where the soil is soft and damp, they penetrate to a very slight extent. On touching the soil the tip swells slightly, and strong rootlets, which soon fix the end firmly in the soil, are developed in great numbers. For some time there is no appearance of any shoot, but the great development of root takes place just a short distance back from the growing point.

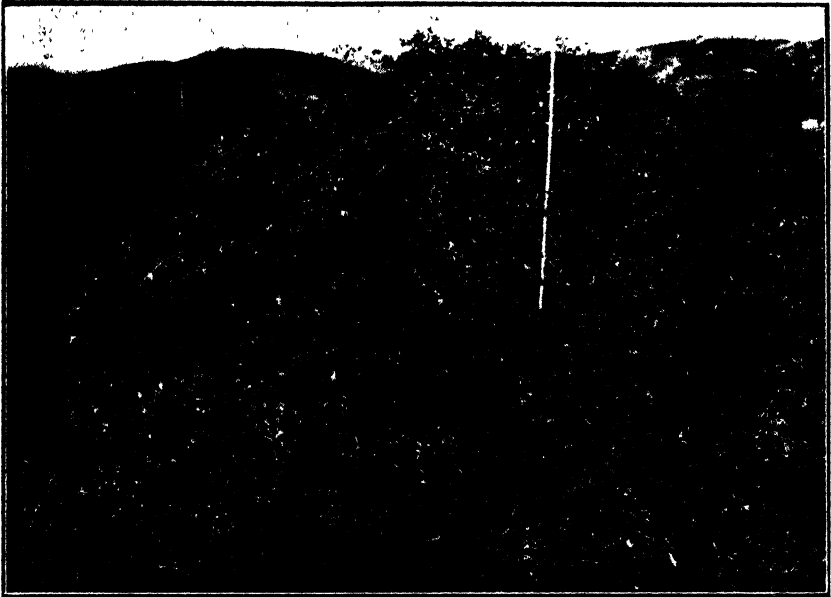


FIG. 4. TYPICAL BLACKBERRY-BUSH IN INFESTED COUNTRY.

Photo by E. F. Northcroft.

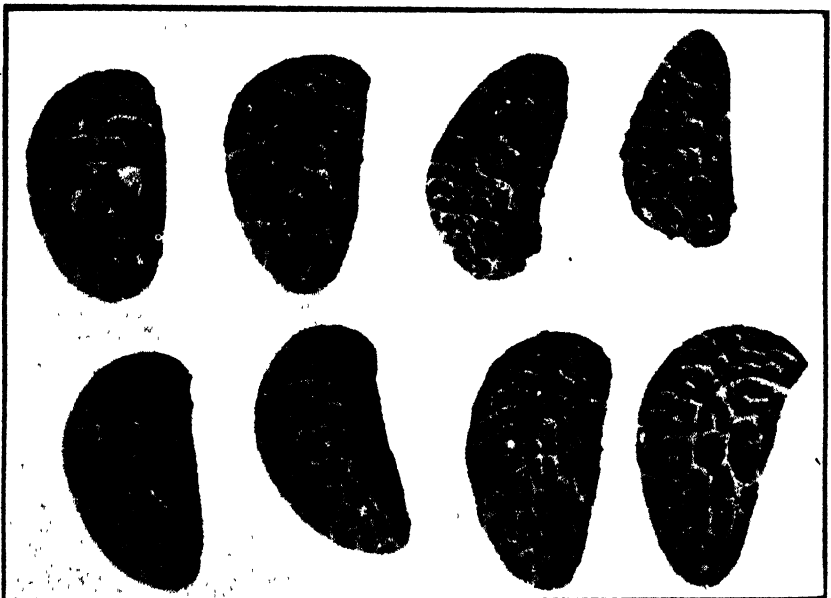


FIG. 5. SEEDS OF BLACKBERRY (*RUBUS FRUTICOSUS*). $\times 20$.

Photo by H. Drake

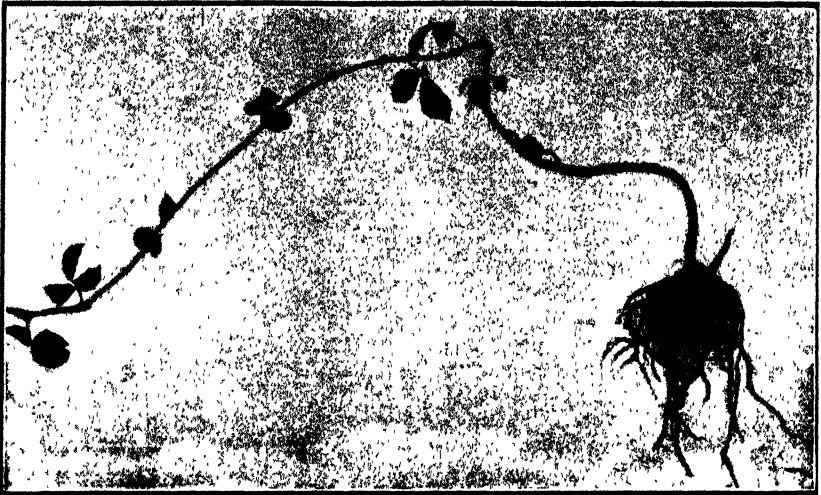


FIG. 6. ROOTING-STEM OF BLACKBERRY, WITH TERMINAL (ON RIGHT) COMMENCING TO ELONGATE.



FIG. 7. ROOTING-STEM OF *RUBUS LACINIATUS* (AT FOOT OF PHOTO).
Also shows gradual reduction of leaves to scales as stem elongates.

[Photos by E. F. Northcroft.]



FIG. 8. ROOTING-REGION OF RUBUS LACINIATUS. ENLARGED.

(Photo by E. F. Northcroft)

Fig. 6 shows a specimen of *Rubus fruticosus* with the shoot just beginning to elongate. Figs. 7 and 8 show the same condition in *R. laciniatus*, but here the shoot has not commenced to grow out (Fig. 8), while the reduction of the leaves to scales is clearly seen in Fig. 7. When the end has become firmly established the tip continues its growth, and a strong shoot is soon developed (Fig. 9). In most cases shoots of this type are abundant round all the bushes, and in this way it is very easy to explain the rapid spread of the weed on a place where only a few plants had originally established themselves. I have frequently measured runners of this type growing in many cases up to 20 ft. long in a single season. Lateral branches of the same form as the parent frequently develop from the leaf-axils of these rooting-stems, and each of these branchlets may become rooted in the manner described; hence in a very short time the bush becomes surrounded by a tangled mass of firmly rooted runners. Fig. 10 shows the end shoots of a single runner of *R. fruticosus* where all the tips had commenced to penetrate the soil preparatory to the development of the adventitious roots.

(3) Cuttings.

Besides the spread of blackberry by seeds and rooting-stems there is the agency of man by cuttings. Throughout the country there are many creeks and rivers with their banks covered by a dense mass of blackberry. By law the weed has to be cleared once a year, and where the banks are not too steep the usual method is to cut down the growth. The cut material is as a rule left, and a great many pieces are allowed to fall or are pushed into the water. Generally no burning is done, but the debris is left for floods to wash away and so clear the upper parts of the watercourse. The result is that large numbers of cuttings



FIG. 9. WELL-DEVELOPED SHOOT OF RUBUS FRUTICOSUS (ON LEFT)
AFTER ELONGATION.



FIG. 10. ROOTING MAIN SHOOT AND LATERALS OF RUBUS FRUTICOSUS.

[Photos by E. F. Northcroft.]

are spread along the banks from the original bushes to the sea, and frequently over the flats is found a crop of young blackberry-cuttings after the flood-waters have receded. These cuttings strike with great readiness, and thus in a very short space of time large areas of flat land and many shallow shingly river-beds are badly infested. These river-bed blackberry-plants are in their turn left to flourish and produce an abundance of seed for the birds to scatter.

CROWN AND ROOTS.

The vines of the blackberry spring from a crown (Fig. 11), which in old bushes very often becomes as much as 6 in. in diameter. From below are given off numerous large, long, stout roots, which travel in all directions and for very great distances. I have traced a number



FIG. 11. BLACKBERRY CROWN, 4 IN. IN DIAMETER

Photo by E. F. Northcroft.

out; the longest, which did not go more than 3 ft. deep, was traced for a distance of 34 ft., and where it broke off was $\frac{1}{4}$ in. in diameter. Generally, however, the main root descends vertically from the crown, penetrating to a great depth, and it is only the secondary roots which seem to travel more or less horizontally; but the general habit of even these secondary roots is to travel horizontally for a few feet and then descend to great depths.

Fig. 12 shows another crown of *Rubus fruticosus*, this being 4 in. in diameter. The main root of this crown I traced to a depth of between 5 ft. and 6 ft., and it was not until it had reached a depth of about 2 ft. that laterals of any size were given off. Frequently lateral roots after penetrating vertically for a foot or two grow horizontally for a time, and stems are often produced from these. Fig. 13 illustrates



FIG. 12. SMALL CROWN AND MAIN ROOT OF RUBUS FRUTICOSUS.

[Photo by H. Drake.

NOTE.—This photo should be viewed vertically from the right-hand side.

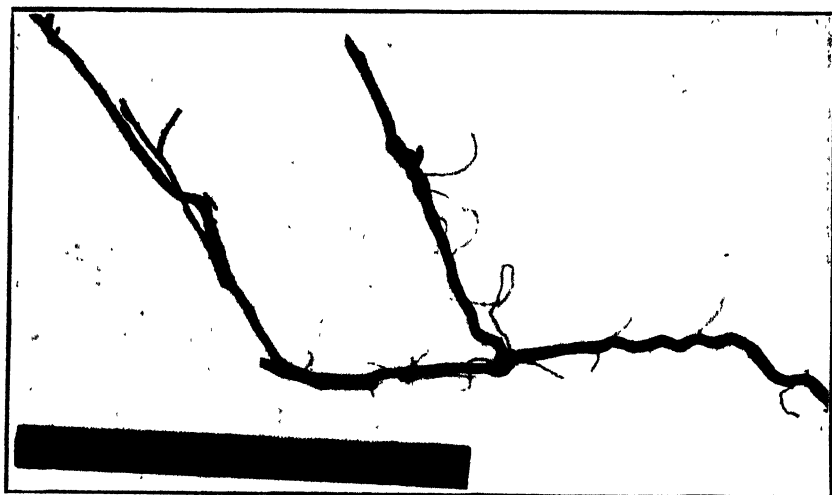


FIG. 13. ROOT OF RUBUS FRUTICOSUS GIVING RISE TO TWO AERIAL SHOOTS.

[Photo by E. F. Northcroft.

a case where two shoots were produced from a lateral root. This root had penetrated to a depth of 15 in., then, running horizontally, had come closer to the surface, and when 6 in. deep the shoots had developed. On following this root farther it was found to take a much more vertical course. Fig. 14 shows a shoot developed from a secondary root 18 in. below the surface.

The roots have very great vitality, and can remain dormant for long periods if conditions are not favourable for the production of aerial shoots. If the tops are cut down to the crown, or even burnt, it is

only a matter of a very few weeks before shoots are appearing from the crown (Fig. 11). If the crown is carefully cut off, then shoots soon develop from just below it, or even all along the main axis right down to a depth of 15 in. (Figs. 15 and 16). A root cut back to a depth of 18 in. and showing a strong development of shoots is seen in Fig. 17, and there is every reason to believe that shoots would develop at even greater depths than this. A root which through river erosion, slips, or other causes becomes exposed, immediately throws out numerous green leafy shoots in great abundance all along the exposed portion. I have often seen roots exposed on a cutting and for a distance of 20 ft. from the crowns becoming covered with leafy shoots.

SEEDLINGS.

The seedlings of *Rubus laciniatus* and *R. fruticosus* are quite distinct from the time of the appearance of the first leaf. Young plants of the former are shown in Fig. 18, and one of the latter in Fig. 19. Both species take a long time to germinate and then to establish themselves. The seeds may lie in the soil a year or fifteen months before they show any visible signs of life. As soon as they germinate they very quickly reach the stage shown in Figs. 18 and 19. Then they remain apparently stationary for a very long time, during which an abundance of root is produced. I have found in many cases the length of the root of the seedling to exceed that of the aerial part by about ten times. One seedling had an aerial part 6 in. high, while the root had travelled vertically down for a distance of 3 ft. 4 in.

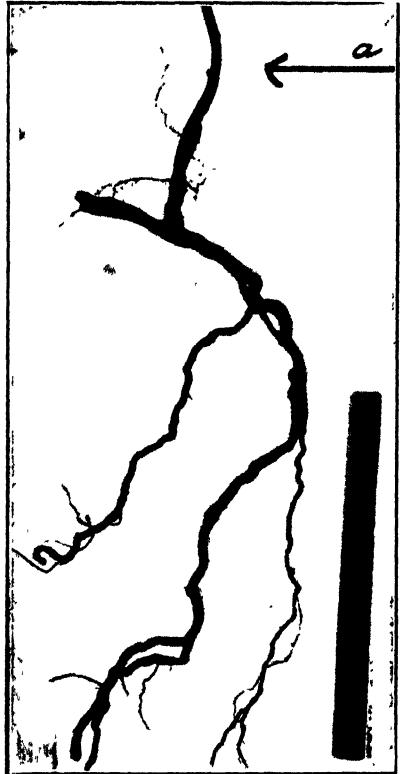


FIG. 14. SHOOT (a) DEVELOPED FROM A SECONDARY ROOT OF RUBUS FRUTICOSUS 18 IN BELOW THE SURFACE.

Photo by E. F. Northcott

GERMINATION.

As indicated, the powers of germination of blackberry-seed are surprisingly poor. Experiments have been carried out with—(1) Fully developed seeds from green fruit; (2) seeds from ripe fruit; (3) badly charred seeds collected after the land had been swept by fire; (4) slightly charred seeds from the same burnt area; (5) seeds passed through birds; (6) seeds from blackberry and apple jam.

In these germination experiments several thousand seeds were tested in germinators—using fully formed seeds from green fruit, seeds

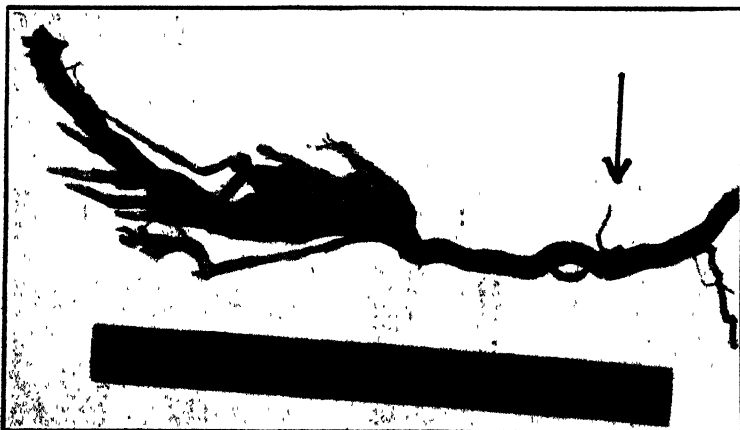


FIG. 15. SHOOT-DEVELOPMENT ON RUBUS FRUTICOSUS DOWN TO A DEPTH OF 15 IN. AFTER THE CROWN HAD BEEN COMPLETELY REMOVED.

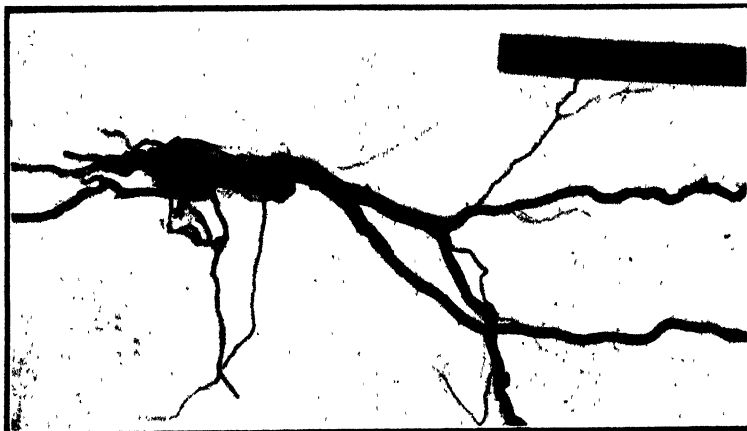


FIG. 16. SHOOTS DEVELOPING ON RUBUS FRUTICOSUS JUST BELOW THE CROWN, WHICH HAD BEEN CUT OFF.

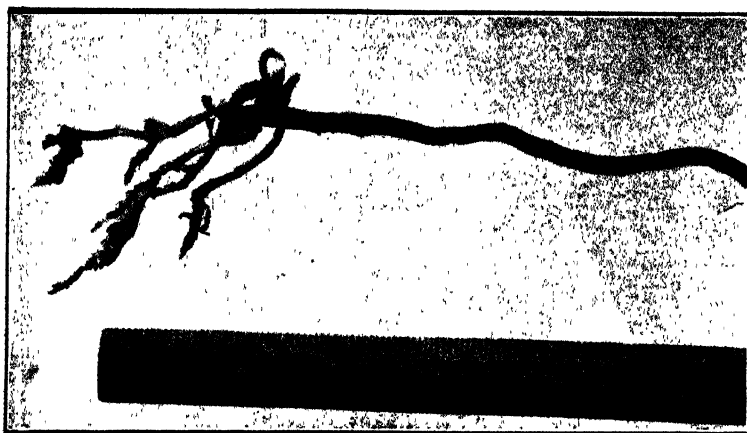


FIG. 17. SHOOTS OF RUBUS FRUTICOSUS DEVELOPING FROM THE ROOT AFTER CROWN AND ROOT HAD BEEN REMOVED TO A DEPTH OF 18 IN.

[Photos by E. F. Northcroft]

from ripe fruit, and seeds from the various jams—without any sign of germination. In a greenhouse the six sets of seeds enumerated in the last paragraph were sown in ordinary garden soil, and germinations took place only in the case of—(1) Fully formed seeds from



FIG. 18. SEEDLINGS OF RUBUS LACINIATUS.

[Photo by E. F. Northcroft.]

green fruit ; (2) seeds from ripe fruit ; and (5) seeds passed through birds. In the two first cases thirteen months passed before there was any sign of germination, and at the end of two years (1) had shown only 4·1 per cent. germination and (2) only 7·3 per cent. In the case of (5), berries of *Rubus fruticosus* and *R. laciniatus* were fed to fowls, and there was no sign of germination till fourteen months. From *R. fruticosus* the percentage germination was 16·7, and from *R. laciniatus* 28·1.



FIG. 19. SEEDLING OF RUBUS FRUTICOSUS.

{Photo by E. F. Northcroft.

In the case of (6), seeds were used from various brands of bought jam, and also from home-made jam ; but in two years there was no sign of any germination. A year ago a further series of jams containing blackberry were procured and tested, but without result. This fact is interesting as well as instructive, as it has been several times emphatically declared that seeds from commercial jam will germinate.

(To be continued.)

WOOL-IMPROVEMENT.

At the meeting of the Board of Agriculture held last month the President reported that he had received a number of replies to a circular memorandum on the question of wool-deterioration, but that sufficient information was not yet available to warrant the Board issuing a report on the subject. A number of samples of wool were submitted and examined by members, and the matter was discussed at some length. It was decided that further steps should be taken to educate farmers in the best methods of wool-growing and in the selection of their breeding-sheep. To this end the Board considered that the Council of the New Zealand College of Agriculture should appoint a lecturer on the subject and make wool a special feature in the training of students attending the college, and that in the meantime the valuable educational work now in the hands of the Department of Agriculture and Mr. W. Perry should be continued and extended as far as circumstances would permit.

Noxious-weeds Order.—The Upper Hutt Borough Council has declared broom, fennel, foxglove, gorse, lupin, ox-eye daisy, pennyroyal, periwinkle, St. John's wort, tauhinu, tutsan, and goat's-rue to be noxious weeds within that borough.

LIMING OF PASTURES.

INITIAL RESULTS OF EXPERIMENTS IN AUCKLAND.

T. H. PATTERSON, H.D.A., Instructor in Agriculture, and J. W. WOODCOCK, N.D.A.,
Assistant Instructor in Agriculture, Auckland.

LIMING is a very old-established practice in British farming, and, as was only to be expected, considerable attention has been given to it in New Zealand. The application of lime to the soil on New Zealand farms, however, is not so widely practised.

In certain districts in the Auckland Province liming pastures and soil for cropping is regarded as a valuable aid in maintaining fertility, and lime is used almost wholly in the form of ground limestone rock, which contains about 90 per cent. of calcium carbonate, its price ranging from about 18s. to 20s. per ton. Where cartage from the railway-station or the shipping-point is not more than about ten miles, lime is regarded by those who use it as an economic soil-improver. How far this opinion is based on sound foundations is difficult to judge. It seems opportune at this juncture, therefore, to examine some of the probable reasons why liming is practised in some districts, but, generally speaking, is rather neglected.

Farmers who do not lime say that it does not pay. Farmers who practise the liming of pastures contend that the colour of the grass is better and clover more abundant; that stock like the pasture better, and that the health of the animals is improved. Liming increases the value of superphosphate: there is a good deal of evidence in support of this. Those, on the other hand, who do not favour lime say that they see no improvement, or, if improvement is admitted, that the same amount of money spent in additional fertilizer dressings (usually phosphatic) pays better. In the case of leguminous crops such as lucerne, peas, &c., farmers generally admit that it pays to lime.

BRIEF GENERAL REVIEW.

The beneficial practice of liming in British agriculture has been widely known in New Zealand, and doubtless has had a far-reaching influence. The success of liming at Edendale, in Southland, where it was first practised on a considerable scale in 1890, drew attention to its undoubted value on Southland soils, and compelled farmers in other parts of New Zealand to consider lime and its use.

Liming experiments conducted by the Department of Agriculture in New Zealand, and recorded in this *Journal* since 1911, show divergent results. At Ruakura Farm of Instruction (June, 1911) oats on light partially drained peat swamp gave no favourable response to amounts of ground limestone ranging from 5 cwt. to 1 ton per acre; oats, however, cannot be regarded as a good indicator crop for testing lime. A catch-crop of peas, oats, and barley followed, with luxuriant growth declining with reduction in the quantity of lime applied.

McTaggart reported tests on pasture on the foothills and the plains of Canterbury, with dressings of $\frac{1}{2}$ ton and 1 ton of burnt lime per acre and double those rates of ground limestone, during 1915 16. On

visual evidence good results were recorded on the limed areas, though the season was dry.

Greenwood's trials at Martinborough, Wairarapa, in 1921 showed increased yields of rape to the extent of 75 per cent. over the control areas. In this case heavy dressings of lime were used in addition to the ordinary rape fertilizers employed. The second season's results (without further liming) with grass and rape gave increased yields to the extent of 46 per cent.

In 1921 Patterson reported that burnt lime at the rate of 68 lb. per acre, applied when sowing down permanent pasture on heavy loam at Motuihi Island, depressed the yield of hay cut the same season.

Dalglish reported favourably in 1923-24 on the use of lime on the light soils of the Waimaunga Experimental Farm, Westland. Pastures, root, and other crops benefited. The heavier soils of the West Coast also showed a good response to lime.

McGillivray recorded in 1924-25 good results with heavy dressings of lime on temporary pasture at Winton Experimental Area, Southland, the clover content being greater on the areas receiving ground limestone than with burnt lime.

Greenwood reported two trials in Marlborough in 1925 on permanent pastures, where lime used with superphosphate showed to advantage when compared with super alone.

Instances may be quoted in Auckland Province. At Albany and Puwera, on heavy gum-lands, burnt lime lightened the sticky clay and made it more friable. Ground limestone used with ground rock phosphate in sowing grass depressed the yield. On pasture top-dressing trials at Te Kumi, where super and ground rock phosphate (Nauru) each were used every year for six successive years, Patterson reported that the yield of hay from the limed areas was lower than from the unlimed, but the quality, judged by the increased clover content and lower percentage of weeds, was better from the limed plots. The differences in weight yield of hay were not statistically significant. Observations over the period of six years showed that the effects of a 1-ton dressing of ground limestone did not show up so markedly in the first as in subsequent seasons.

In the last April issue of the *Journal* Hudson reported carefully planned and examined Canterbury trials with 1 ton of ground limestone as a top-dressing on pasture, applied in 1924 in most cases, and manured with phosphatic fertilizers. Lime gave varied results as judged by the comparison in the weight of hay harvested. He regards his conclusions so far as tentative, awaiting further data from extended trials.

Most of the trials cited in the review just given were not planned with the idea of subjecting the results to the severe scrutiny of the most modern methods of field experimentation, nor would they probably stand such a test. Hence the results given in such cases and the observations made by the respective experimenters should be accepted only on this understanding. The results, nevertheless, are full of interest to those desirous of getting at the pros and cons of liming.

Mr. B. C. Aston, Chemist to the Department of Agriculture, has for many years past drawn attention to the agricultural value of lime, and has published chemical analyses of soil-samples widely drawn, which indicate in the Auckland Province and elsewhere a high lime-requirement.

The Present Auckland Experiments.

With the object of further testing the value of lime, experiments were started in Auckland Province last year. It is intended to continue these trials, and to extend the number, with the object of ascertaining whether lime is economically valuable on pastures with and without the ordinary fertilizers.

The success which has attended the top-dressing of grassland with phosphates during the last few years has resulted in a great increase in this practice. Many farmers in Auckland Province who only a few years ago applied an annual dressing of 2 cwt. per acre are now putting on up to 5 cwt. and 6 cwt. each year, while in a few instances 10 cwt. per acre is applied. There is no doubt that on these heavily top-dressed soils far more phosphate is being added than is removed by crops and stock, and as phosphate is not removed by drainage there must be good reserves accumulated in the soil. These phosphatic reserves may exist in different forms according to the nature of the soil constituents; yet even in such cases top-dressing is necessary each year, since the store of phosphate in the soil is apparently unavailable. This is especially liable to occur when a water-soluble phosphate is applied to a soil deficient in lime. The phosphate is precipitated in the soil, and if there is no calcium with which to combine it will probably unite with the bases aluminium or iron, forming combinations regarded as not so readily available.

An experiment was commenced in 1926 at two centres in Auckland Province to ascertain whether such soils, which had been heavily phosphated in the past, would yield some of their wasted phosphate fertility when treated with lime in one of its forms.

Plots were treated with the following dressings per acre: (1) 3 cwt. superphosphate, 44/46 per cent. grade; (2) 2 tons ground limestone (Te Kuiti); (3) 1 ton burnt rock lime. A fourth plot was left unmanured as a check.

The plots were laid down the width of the manure-drill (8 ft. wide) across the field for a distance of 6 chains, and alternated in such a way that each plot could be compared with a plot of different treatment adjacent. There were six series, giving twenty-five strips in all, and allowing twenty-four comparisons between each treatment. Six areas, each $\frac{1}{15}$ of an acre, were taken on each plot. The method of cutting and weighing was similar to that employed by the Fields Division in Canterbury, as described in the *Journal* for June, 1925, the grass being weighed green in the swath as soon as mown. In order to express the results in a convenient form so that the financial aspect may be reviewed, the weight of green material is here expressed as hay. For this purpose the hay weight is regarded as being one-third of the green weight, and the value of 1 ton of hay can be reckoned as £5.

FARM OF J. SUTHERLAND, KIHIKIHI, WAIKATO.

The soil on this area is a residual volcanic, being a heavy loam moderately supplied with humus. The pasture was laid down twelve years ago, and has since received annual dressings of superphosphate or basic slag, 2-3 cwt. per acre. During the past four years two dressings per year have been applied. In the early autumn of 1926 the dressing

was varied, and consisted of a mixture of equal parts bonedust, superphosphate, and sulphate of potash. The field has been cut for ensilage for several years. The plots were treated on 13th September, 1926, and the field was closed during the second week in October. On 7th December it was cut for ensilage and the plots were weighed.

The weight factor as an indication of improvement: An increase in weight on a plot treated with phosphate or lime over an untreated plot can always be reckoned as an indication of improvement. It is realized that herbage from a plot so treated is superior in feeding-quality to unmanured grass, and therefore a weight increase must be a criterion when the increase is in response to manurial treatment. When two manurial treatments are compared the superiority of one over the other as shown by weight increase is not so evident. Since, however, the object of the present experiment was to release phosphate and make it available to the plant on the one hand, and to apply available phosphate on the other, we assume that any increase in weight of herbage is mainly due to such causes. During the growth period there was no visible difference between the plots, but a few weeks after cutting there was a striking contrast, as will be described later.

Table 1.

Treatment Comparison, A versus B.	Weight expressed as Tons of Hay per Acre.		Difference Significant (S.) or Not Significant (N.S.).
	Yield.	Difference in Favour of A.	
A. Super	3.356	0.381	S.
B. Control	2.975		
A. Lime carbonate	3.125	0.334	S.
B. Control	2.791		
A. Control	2.572	0.081	N.S.
B. Burnt lime	2.491		
A. Super	3.150	0.353	S.
B. Lime carbonate	2.797		
A. Super	3.231	0.451	S.
B. Burnt lime	2.780		
A. Lime carbonate	3.086	0.366	S.
B. Burnt lime	2.720		

NOTE.—Difference not significant when chances in favour of treatment are less than 30 to 1.

Comments on Table 1.—Treatment versus no manure: Both super and carbonate of lime have given significant increases over no manure, but, whereas the application of superphosphate has given a profit of approximately £1 1s. in the first year, there has been a loss in the case of the carbonate. An application of 2 tons in one year, especially as the crop was cut within four months of treatment, could scarcely be expected to pay for such application in the first year. As it is, the results from carbonate of lime are highly satisfactory. Burnt lime has caused a depression when compared with the natural yield, but this difference is not significant.

Super *versus* lime : When super is compared with carbonate, the former shows its superiority by a difference of 0.353 ton per acre. While one cannot generalize in such a short time, it would appear from the first year's figures that even when previous history, supported by chemical analysis of the soil, indicates a sufficiency of phosphate the application of a suitable phosphatic top-dressing is a payable proposition. Superphosphate gives a great increase over burnt lime, which has given poor results so far in this experiment during the period under review.

Examination of the aftermath : An inspection of the plots a month after cutting showed that the super and carbonate plots stood out clearly from the others by reason of the fine growth of perennial ryegrass. The control and burnt-lime plots showed little growth of ryegrass, and appeared a flowery mass of catsear and hawkbit. Although a certain amount of each of these weeds appeared in the super and carbonate - of - lime plots, yet only a small proportion was present as compared with the others.

FARM OF B. J. ROULSTON, PUKEKOHE.

The soil here is a medium chocolate volcanic loam, typical of much land in the dairying district round Pukekohe. The pasture, consisting of good-quality grasses, chiefly ryegrass and meadow-foxtail, was laid down in 1915. For seven years it was top-dressed annually with 2 cwt. of either basic slag or superphosphate, chiefly the former. Four years ago 3 cwt. basic slag was applied, and this was followed with a mixture of 3 cwt. super and guano for two years. The plots were treated on 30th August, 1926, and the field was closed for hay in early October. On 11th December it was cut and the plots weighed. At no time during the growth period was any difference noted.

Table 2

Treatment Comparison, A <i>versus</i> B.	Weight expressed as Tons of Hay per Acre.		Difference Significant (S.) or Not Significant (N S.).
	Yield.	Difference in Favour of A.	
A. Super	3.037	0.062	N S
B. Check	2.975		
A. Check	2.675	0.022	N.S
B. Lime carbonate	2.653		
A. Burnt lime	2.901	0.025	N.S.
B. Check	2.876		
A. Super	2.996	0.052	N S.
B. Lime carbonate	2.944		
A. Super	2.876	0.176	S.
B. Burnt lime	2.700		
A. Burnt lime	2.913	0.012	N S.
B. Lime carbonate	2.901		

Comments on Table 2.—The only significant difference is that between super and burnt lime, the other comparisons not being measurable with certainty. Even super has given no significant increase over no manure. When the aftermath was examined one month after cutting there was no visible difference between any of the plots.

RELATION OF RESULTS TO CHEMICAL ANALYSIS.

According to chemical analyses made at the Department's Laboratory the Kihikihi soil, although slightly deficient in available phosphate, is correspondingly well supplied with total phosphate. The Pukekohe soil in comparison is poorly supplied. Both soils are deficient in lime. Details are given in the following table :—

Table 3.
Percentages on Top Soil dried at 100° C.

	Kihikihi Soil.	Pukekohe Soil.
Total phosphoric acid	0.18 per cent. ..	0.09 per cent.
Available phosphoric acid	0.009 per cent. ..	0.002 per cent.
Lime - requirement (Hutchinson and McLennan method)	4.8 tons per acre	3.4 tons per acre.

One can hardly explain why after ten years' continuous top-dressing the phosphate deficiency should be so high on the Pukekohe soil. It is a well-known fact that this is a type of soil particularly responsive and liberal, otherwise it would not be valued so highly. Economic conditions on such high-priced land force high production and intensive farming methods. The field was only 2 acres in extent, and has been heavily stocked. But we have here two soils, one with a much higher phosphate content than the other. When a heavy dressing of carbonate of lime is applied to the Kihikihi soil there is an immediate response, but such treatment has had no effect on the Pukekohe soil. Yet superphosphate has only given an immediate result in one case, and that on the soil with the higher phosphate content. This probably serves to show the limitations of soil analysis without support of field evidence. Superphosphate was used in these experiments not because it was thought to be the best type of phosphate to use in each case, but to obtain uniformity. Field experiments conducted in the Pukekohe district over a number of years seem to indicate that basic slag and rock phosphate give better results than super, probably on account of the high iron-content of the soil. Farm practice in this district also supports that view, and when super is applied it is almost invariably mixed with lime; but basic slag and basic super are more favoured.

CONCLUSION.

In conclusion, it must be remembered that these results were obtained within four months of treatment. Therefore one cannot draw too definite conclusions regarding the failure of any one treatment. An immediate response is expected in the case of superphosphate, but the effect of lime is often belated. After two or three years' results have been obtained, together with repeated observations regarding the nature of the herbage, we shall probably be able to make definite assertions as to whether heavy dressings of lime are economical.

We tender our thanks to Mr. Sutherland and Mr. Roulston, who co-operated with the Department; also to Mr. G. Wild and other officers of the Fields Division, who took part in the experimental work

THE EUROPEAN EARWIG: ITS HABITS AND CONTROL.

SOME RECENT EXPERIMENTAL WORK IN NEW ZEALAND.

J. MUGGERIDGE, Biological Laboratory, Wellington.

EARWIGS are readily recognized by their characteristic wings and forceps. The forewings are small leathery coverings which extend a short way along the back, while the hindwings are large and when not in use are compactly folded beneath the forewings. All earwigs have forceps or "pincers"; these arise from the posterior end of the body, and vary in shape according to sex.

According to Fulton the name "earwig" originated in the Anglo-Saxon word *earwicya*, meaning "ear-creature." He states that the name has the same significance in nearly all European languages, point-



FIG. 1. MALE EUROPEAN EARWIG. $\times 6$.

[Photo by H. Drake.]

ing to the widespread belief that earwigs crawl into the ears of sleeping persons. There are, however, no grounds to substantiate any such belief, except that the earwig will go into any crevice for shelter during the day, like any other nocturnal insect.

In New Zealand earwigs are poorly represented among the native insects, and none is injurious. The species so prevalent and injurious in the Dominion, especially in the South Island, is the European earwig (*Forficula auricularia* Linn.). The adult measures from $\frac{1}{2}$ in. to $\frac{3}{4}$ in. long; the forceps of the male (Fig. 1) are stout and strongly curved, while those of the female (Fig. 2) are comparatively straight. The general colour of the insect is dark or reddish brown, though occasionally a whitish one occurs. In the case of the latter the skin has just been shed and the permanent dark colour has not yet developed.

During the last few years the European earwig has become a pest of considerable economic importance to both town and country dwellers, but more especially to fruitgrowers.



FIG. 2. HIBERNATING FEMALE EARWIG, WITH EGGS. GREATLY ENLARGED.

[Photo by H. Drake.]

Life-history and Habits.

Mr. D. Miller has studied the life-history of the insect in New Zealand, and has found it to differ but little from what takes place in other countries.

The winter is passed in the adult and egg stages underground, or in some other suitably moist and sheltered place. Both sexes hibernate, but the female lies with her batch of eggs laid in the ground (Fig. 2). If by any chance the eggs are scattered the female will gather them together, carrying one at a time in her jaws.

During August and early September, as a rule, the eggs hatch and the minute white earwigs swarm in the ground (Fig. 3 *a*). Earwigs are nocturnal, and on the first night after hatching the young insects leave the ground and feed upon the tender parts of plants. They eat out small holes on young leaves (Fig. 4), or feed upon the pollen, stamens, &c., of flowers. As the insect grows to the adult form it sheds its skin four times as a rule, and after each moult the developing wings become more conspicuous (Fig. 3 *a-d*). Maturity is reached about November and December, and it is at that time or a little earlier that the earwigs attract attention, since in the younger stages they are much less conspicuous. The hibernating males and females live for some time after emerging from hibernation, and frequently mate in September or October, when a second batch of eggs is laid by the female, after which these adults die. Therefore individuals of various ages from the early and late spring broods are found at the same time.

Earwigs do not confine their depredations to the open, but make themselves particularly disliked through their habit of invading dwellings. At night-time they come out of their places of concealment in search of food, and at daylight seek shelter again under boards or pieces of sacking and the like. This habit provides one means of control, as will be mentioned later. Their food range is very extensive, including practically anything that may be considered edible: even cannibalism is resorted to in some instances. It is stated that the earwig is an enemy of codlin-moth. This may be so, but it was noticeable during the past season that in some parts where heaviest earwig infestation occurred the codlin-moth was also very prevalent—indeed, worse than for several years. Thus, even if the earwig is an enemy to the moth larva, its economic value as a controllant is not to be relied upon.

As already indicated, owing to the infestation of fruit the earwig has become a significant economic pest to the orchardist, the types of injury being such as to depreciate considerably the market value of this commodity. One of the worst features is the fact that the insect is able to conceal itself within the fruit.

Control Measures.

A great deal of work has already been done on earwig control—both biological and chemical—in other parts of the world, notably from the chemical aspect by Fulton.*

The present discussion deals mainly with poison-bait control, and but little with natural enemies. Among the latter are birds, insects,

* Fulton, B. B.: The European Earwig. *Oregon Agricultural College Bulletin* 207.

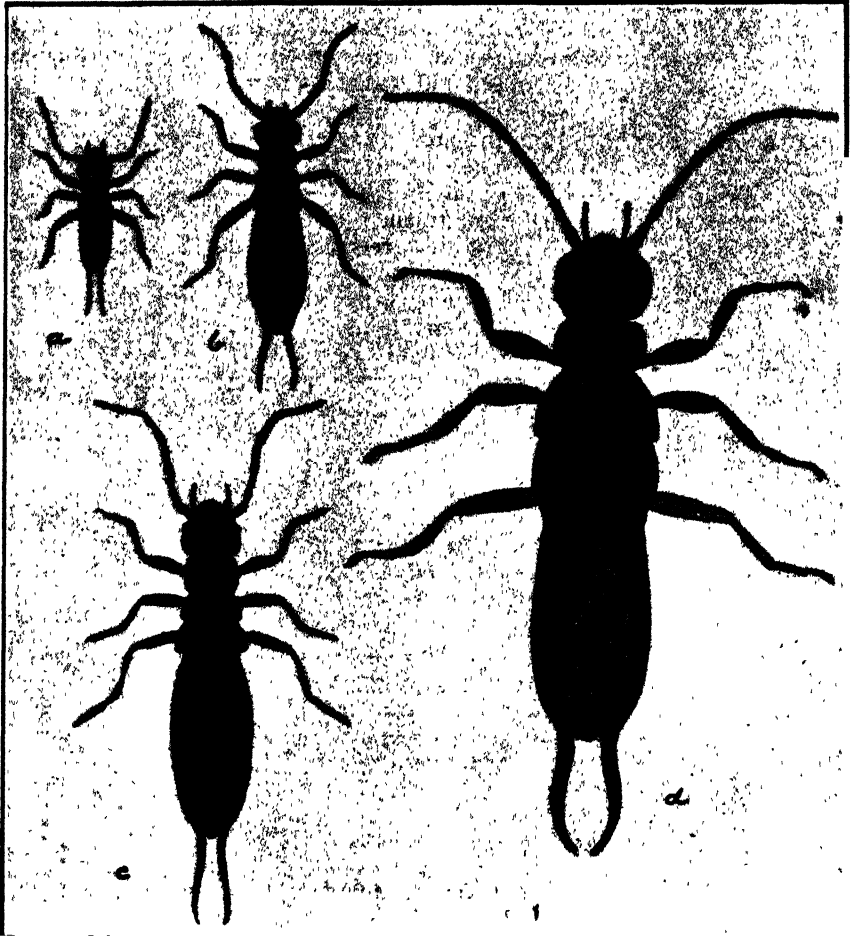


FIG. 3. PRE-ADULT STAGES OF EARWIG.
(a) Newly hatched ; (d) immediately before adult.

and perhaps hedgehogs. Control by beneficial insects is not treated here, since this aspect is being handled by the Cawthron Institute. In addition there are other methods of control, such as traps and barriers : these, however, are less important, and will be only briefly dealt with.

It is as well to point out here any attempts at artificial control can be rendered almost useless by lack of co-operation among the people concerned. It is of no use for one man to go to a great deal of expense and trouble in dealing with the earwig when his immediate neighbour takes no interest in the matter. This aspect must receive more attention in the future if control is to be successful.

POISON BAITS.

It is not difficult to find a poison that will kill the earwig, the difficulty at present is to find something that is more palatable than is to be found in the orchard. A certain amount of work was first

of all carried out at this Laboratory in order to get a fair indication as to what was the best and most economical poison to use, and the strengths of the solutions required. The poisons used were paris green, sodium arsenite, white arsenic, and sodium fluoride.

Orchardists have from time to time experimented with paris green, but without success. It is probable, however, that they expected the earwigs to die within a few minutes of feeding; this, of course, does not take place, since the poison is slow-acting, taking anything from one to ten days to kill, according to the amount used. In an experiment conducted at the Laboratory paris green was made up according to a standard formula—namely, 1 oz. paris green to 1 lb. of crumbled stale bread, thoroughly mixed, and then made sufficiently damp so that the water can just be squeezed from the bread. When this was fed to earwigs confined in a box 50 per cent. were killed in twenty-four hours and 80 per cent. in forty-eight hours. The formula may be quite useful to town dwellers, but is too expensive for larger areas.

Sodium-arsenite poison was made up as follows: 1 grm. of sodium arsenite dissolved in 100 c.c. of water, 10 c.c. of molasses added, and the whole then mixed with 3 oz. of bran. When fed to the earwigs this material took four days to kill 40 per cent. In greater strengths this would prove too costly. In experiments with sodium fluoride and white arsenic wheat bran was used as a bait at the rate of 2½ oz. to 3 oz. per 100 c.c. of water, with 10 c.c. of molasses added to make it attractive. The bait is made up by dissolving the poison in the required amount of water, then adding the molasses and pouring the whole on to the bran, mixing thoroughly to ensure even distribution of the poison. The results obtained are condensed in the following table:—

Poison used.	Quantity.	Time soaked.	Percentage of Earwigs killed.	Time taken to kill.
White arsenic ..	1 gramme	20 minutes*	100	2 days
" ..	1 "	1 hour	20	10 "
" ..	1 "	4 hours	30	10 "
" ..	1 "	4 days	70	10 "
" ..	1 "	6 "	100	3 "
" ..	1 "	10 "	100	2½ "
Sodium fluoride	1 "	"	80	10 "
" ..	1 "	"	85	10 "
" ..	2 "	"	90	9 "
" ..	3 "	"	100	8 "

* Owing to insolubility of white arsenic it was boiled in this instance.

The table indicates that white arsenic, at the rate of 1 grm. per 100 c.c., and soaked for ten days, is so far the best poison to use. There are, however, certain drawbacks attached to the use of this chemical, and comparing it with sodium fluoride we find that the latter has important advantages, since it is less poisonous to human beings and farm animals, and, according to Fulton, is as toxic or more so to the earwig. The latter point, however, is not borne out by the foregoing experiments. Sodium fluoride is far more soluble than white arsenic, and thus easier to incorporate in a poison bait, but, unfortunately, it is much dearer to use. Further experiments with sodium fluoride were not possible, since an additional supply was not obtainable in New Zealand.

These laboratory experiments were carried out in February and March, so that little time was left for field trials. As a preliminary, however, the following work was carried out in Mr. Kinnaird's orchard at Earnsclough, Central Otago: 1½ lb. of white arsenic was boiled in 12 gallons of water (soaking for ten days would do just as well), 21 lb. treacle was added, and the whole mixed with 10 lb. bran. As a test a handful of the poisoned bran was placed in a benzine-tin containing earwigs, and in twenty-four hours 30 per cent. of the insects were found dead. The bran was scattered close around the base of the trees, and a handful also placed in the tree-crotches. At the end of twenty-four hours a search did not reveal any dead earwigs, though all those seen were very sluggish. This was in part due to a cold snap, and in part no doubt to the poison.



FIG. 4. YOUNG LEAF ATTACKED BY YOUNG EARWIGS.

[Photo by H. Drake.]

“BARRIERS.”

This method of control has a limited application, and, to the writer's knowledge, the only useful barrier in use at present is the commercial preparation *Orbite*, which has been introduced and used quite effectively by Mr. Hinton, of Earnsclough. This viscid substance is painted in the form of a band round the base of the tree. Here, owing to its extreme stickiness, it prevents the passage upwards of the insect. It is essential that the base of the tree be kept free from weeds whenever *Orbite* is used, since long grass and the like forms a passage across the barrier, thus rendering it useless.

The writer experimented with sodium fluosilicate, spreading the powder round the base of the tree. This, however, proved quite ineffective, as under certain conditions, notably after rain, when a crust formed on the surface, numbers of earwigs were found to have passed over the preparation.

FUMIGANTS.

The use of calcium cyanide can be confidently recommended, but owing to the cost it can be used economically only under certain conditions. For example, where boxes are stacked care should be taken to space them at the base, so that calcium cyanide may be blown into the stack by means of a dust-gun. If the stacks of cases are made

small enough for a cover to be thrown over them less fumigant will be required and the control will be more effective.

In the vegetable-garden cyanide dust can be effectively used, particularly among cabbages, where large numbers of earwigs are frequently concealed. Apart from its effect on earwigs the cyanide kills other injurious insects, especially aphids.

The writer does not know of any poison that will kill earwigs as quickly as hydrocyanic-acid gas, which proves fatal to them within one to two minutes after application. Caution is necessary in handling this substance; a tin should never be opened in a closed room unless it is particularly well ventilated; every care should also be taken not to inhale the gas.

TRAPS.

Traps for earwigs have been in use for many years, and various types have been employed quite effectively. One such is to place straw in a flower-pot and invert this over a stake driven into the ground. The earwigs seek shelter in the pot during the day, and the contents may then be shaken into hot water or kerosene and the insects destroyed. Pieces of folded sacking or paper left about in tree-crotches or on the ground may similarly be used. Thus by the use of such simple means numbers of the pest may be destroyed.

NATURAL ENEMIES.

Hedgehogs were introduced at Alexandra (Central Otago) in the hope that they would account for a portion of the earwigs, and having in mind also the fact that these animals destroy other pests, notably snails and slugs. Some of these hedgehogs were dissected by Mr. E. F. Northcroft, of the Biological Laboratory, but no earwig-remains were found in the alimentary tracts of the animals. Further dissections will be made in the coming season.

An examination of the excreta of the brown owl (*Athene nocturna*) showed the remains of a large number of earwigs.

CONCLUSIONS.

No definite conclusions can yet be drawn as to which is the best poison to use, since a good deal of field-work still has to be carried out. It is hoped to make a much earlier start on this phase of the work during the coming season. The main advantage of an early application of the poison lies in the fact that insects when young are more readily* poisoned. With regard to traps and barriers, the main feature of the former is perhaps the personal satisfaction obtained, while the latter, though perhaps effective in keeping the earwigs from certain places, does not reduce the numbers. Calcium cyanide as a fumigant is very useful in confined places, but at present is hardly feasible for control in the open.

For assistance in carrying out the field-work here recorded the writer is indebted to Mr. W. R. Lloyd Williams, Orchard Instructor, Alexandra. Thanks are also due to Mr. Kinnaird, at Earnsclough, for maintaining a constant supply of earwigs during the laboratory experiments.

* Fink, D. E.: Physiological Studies of the Effect of Arsenicals on the Respiratory Metabolism of Insects. *Jour. of Agricultural Research*, vol. 33, pp. 993-1007.

FUNGUS DISEASE ATTACKING ARTICHOKES.

INCIDENCE, LIFE-HISTORY, AND REMEDIAL TREATMENT.

G. H. CUNNINGHAM, Mycologist, Biological Laboratory, Wellington.

DURING recent years the Jerusalem artichoke (*Helianthus tuberosus*) has been widely grown for pig-feed in New Zealand, and the area is increasing each season. The usual method practised by farmers has been to plant the tubers in drills like potatoes, and when the crop has matured to fence off portions and allow pigs to root out and eat the tubers. When the area has been well worked over by pigs these animals are excluded, and the ground is harrowed, permitting a second crop to mature from those tubers overlooked by the pigs. In this manner certain areas have been kept constantly under artichokes for the past four or five years. One disadvantage of this method lies in the fact that as a rule small tubers only are left by the pigs, the yield in consequence becoming less each season. Therefore a modification of this practice is now being advocated by the Department of Agriculture. This consists in lifting, before the pigs are turned on the area, a quantity of large tubers sufficient to plant the area; then when the pigs have been removed the land is cultivated and replanted with these tubers. In this way constancy of crop-yield is secured.

A more serious obstacle to the utilization of the same land for artichokes for several seasons has arisen during the past few seasons, in the form of a disease which has become widespread. Where at all prevalent it has caused the abandonment of the affected areas, as it may at times destroy half or more of the crop. Fresh plantings have been made, and these in turn become infected, usually owing to the use of seed tubers taken from the previously infected crop.

Requests for information concerning this disease and its possible control have become so numerous that the present article—necessarily incomplete—has been written to supply what information is available.

The disease becomes noticeable in a paddock of artichokes in that certain plants in late spring or early summer show signs of wilting, the foliage becomes blackened, and the plant soon is killed. Generally, death of these initial plants (which are almost always overlooked) is followed by wilt and death of numerous others in their vicinity, until definite diseased areas (or "patches," as the farmer terms them) become well established and then readily noticeable. These areas may continue to increase in size gradually through the season, until in the late autumn they may cover an extent of one-third of an acre or even more. Death of the plant is usually followed by its collapse, and the prostrate discoloured stems then become very prominent (Fig. 1).

Examination of a diseased stem shows the presence, usually near ground-level, but often 1 ft. to 2 ft. above the surface of the ground, of a dense white or light-coloured fungous growth covering the stem often for a foot or more of its length (Fig. 2). The tissues lying beneath this region appear dead and discoloured, and embedded in

the fungous mycelium appear numerous shot-like, usually black bodies of irregular size and shape, termed sclerotia (Fig. 3). Their significance will be made apparent later.

The wilt and death of plants, their frequent appearance in irregularly circular patches, presence of the fungus growth on the cankered portions of the stem, with accompanying sclerotia, are the characters of the disease.

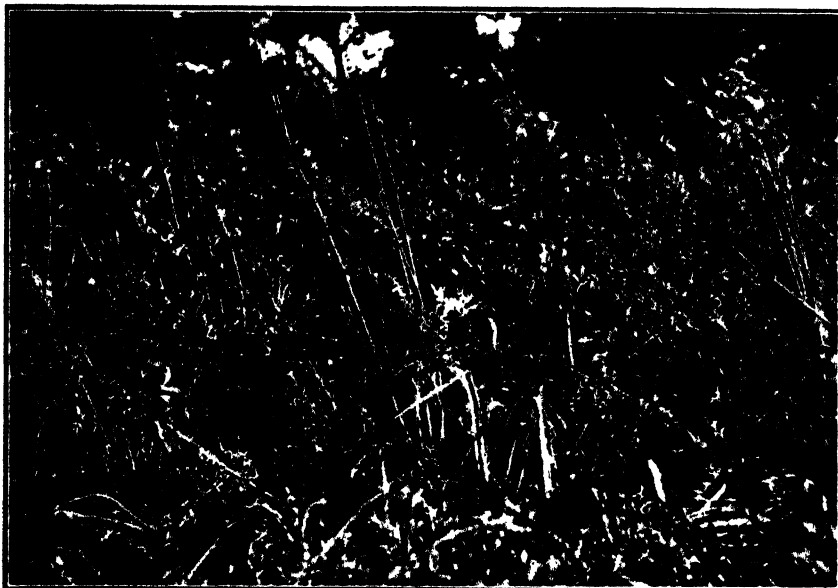


FIG. 1. DISEASED AREA IN ARTICHOKE FIELD, SHOWING NUMEROUS DEAD, FALLEN STEMS.

[Photo by Writer

HOSTS OF THE CAUSAL ORGANISM.

The disease is by no means confined to artichokes, for in New Zealand it has proved one of the most serious fungous diseases with which we have to contend, attacking as it does so many crop, orchard, and garden plants. The following list of plants on which the causal organism has been collected in New Zealand will give some idea of its wide host range: Antirrhinum (cultivated), artichokes (Jerusalem), bean (broad or Windsor, butter, French, horse, soya), Brassicas (chou moellier, cabbage, kale, rape, swede, and turnip), carnation, Cape gooseberry (*Physalis peruviana*), Canadian thistle (*Cnicus arvensis*), carrot, celery, cucumber, curled dock (*Rumex crispus*), dahlia (cultivated), fat-hen (*Chenopodium album*), fennel (*Foeniculum vulgare*), lettuce, lemon (fruits and shoots), mangold, melon, potato, pea, parsnip, pelargonium (cultivated), passion-fruit, spear thistle (*Cnicus lanceolatus*), sweet-pea, sunflower, spinach, tomato, tree-mallow (*Lavatera arborea*), tree-tomato (*Cyphomandra betacea*), tulip, and wing thistle (*Carduus pycnocephalus*).

The disease has with us in certain seasons proved to be one of the most serious troubles of lettuce, potato, sunflower, and tomato.

CAUSAL ORGANISM.

This disease has been found to be caused by the fungus *Sclerotinia sclerotiorum* (Lib.) Mass. (7), an organism which has been in North America usually named *S. Libertiana* Fcl. As it occurs on many hosts it has at times received many different names, those of recent application being *S. intermedia* Ramsey (9), *S. minor* Jagger (5), and *S. perplexa* Lawrence (6); for comparisons of the published descriptions of these show they all agree with *S. sclerotiorum*, differing only in certain characters which cannot be considered as possessing specific value.



FIG. 2. DISEASED PLANT, SHOWING WHITE FUNGOUS GROWTH ON STEMS. REDUCED.

(Photo by Writer.

Identification of the fungus on the hosts enumerated was carried out in two ways: (1) The sclerotia were germinated and ascospores obtained; (2) sclerotia were plated to media and their cultural characters studied. These were compared with cultures made from ascospores, and all were found to agree to the extent that separation of any one was not possible, although considerable variation was noted in certain particulars, such as growth-rate of the mycelium, size of sclerotia produced on media, &c. Apothecia were obtained from germinated sclerotia taken from artichoke, carrot, celery, cucumber, lettuce, pea, potato, tomato, and tree-mallow.

LIFE-HISTORY.

Opinions differ among pathologists as to the method by which infection occurs in the field, one view being that ascospores produced from germinating sclerotia in the spring cannot attack the host directly, but must first develop a copious saprophytic mycelium (presumably in the soil) which later attains the parasitic condition. This statement is invariably attributed to de Bary, but, as Pethybridge has pointed out (see below), his original statement did not convey this meaning. This opinion was regularly held by most of those who have published on this organism, until a paper by Pethybridge appeared (8), in which direct infection by ascospores of potato-haulms was secured. His observations are so informative as to bear reproduction:—

In the spring and summer these sclerotia, which are then to be found in and on the soil, germinate and produce stalked "spore-cups" (apothecia), from which little puffs or clouds of spores can be seen to proceed. Nothing could be simpler than to suppose that the potato-plants become infected directly from these airborne spores. Arguments have, however, been brought forward which seem to show the impossibility, or at least the improbability, of this mode of infection. Thus de Bary found that when the spores germinated in water the germ tubes were

quite unable to penetrate the living healthy tissue of the plant. If, however, germination took place in a nutritive solution, instead of in water only, the germ tubes were found to be capable of producing infection. So impressed was de Bary with this difference in behaviour of the spores according as to whether they germinated in pure water or in a food solution that he went so far as to state (3, p. 380) that the fungus always requires to pass through a previous stage of existence as a saprophyte in order to be capable of parasitism. The expression "previous stage of existence" appears to have had a somewhat exaggerated importance attached to it, at least from the practical point of view, and has led to the idea being promulgated that in one stage of its life-history the fungus lives saprophytically—*i.e.*, in decaying manure or organic matter in the soil—and hence it has generally been maintained that the potato-plant becomes attacked at soil-level by the invasion of saprophytically nourished mycelium from the soil. This view of the mode of infection by this fungus is, of course, supported by the experiments carried out by de Bary on potted plants of zinnia (2, p. 378). Ten of such plants were contained in a single pot of soil, and placed in contact with the base of the stem of one of them was a piece of carrot on which the fungus was living. Ultimately nine out of the ten plants succumbed, the attack in each case taking place at the soil-level. This result can scarcely be regarded as surprising, but it is not necessary to conclude from it that in the field the attack must always come from the soil. . . . Up to the present, at any rate, no one has reported the finding of this fungus living naturally in the soil as a saprophyte.

It is true that in the case of the potato the point of attack is often at or near soil-level. But . . . the points of attack are very frequently found at a considerable distance above soil-level, so that there can be no question of infection from the soil at such places.

In the same paper Pethybridge records experiments in which he proved conclusively that haulms and leaves could become infected directly by ascospores. He further remarks (p. 17):—

Observations of plants in the plots strongly suggest that in the main an entry into the plant is gained in two or three ways. The first of these is through the older, shaded, yellowing leaves, which ultimately fall off. The fungus is not infrequently found on them, and makes its way down the leaf-stalk, and thus its mycelium reaches the stem of the plant and enters it. It seems quite possible that the germinating spores might be able to secure an entry into such dying leaves, whereas they would still be unable to directly infect perfectly healthy ones. . . . The second point of entry which suggests itself consists of the series of wounds left on the stalks by the falling leaves. In any case it is a fact that far the greater number of cases of infection occur at a node. The essential fact which has been brought out by those experiments of the past season remains—*viz.*, that the attack of the potato-plant with this disease takes place chiefly from aerially-borne spores, and not, as has hitherto been maintained, from the soil.

Dowson (4), working with this organism on antirrhinums, was able to produce infection when ascospores were either inoculated into wounds or placed directly on the host-tissues. He also succeeded in obtaining infection with mycelium. Ramsey (10) was able to produce severe infection by spraying a suspension of ascospores over the freshly cut leaves of lettuce. Thus recent workers have shown ascospore infection of the host occurs quite readily.

Field observations on artichokes show that infection some distance above the ground is quite common; and from what has been written it is obvious that such infection must occur from ascospores. Consequently, despite the observations of earlier workers, ascospore infection must be considered as the source of primary infection. This view is strengthened by the fact that these early infections occur in late spring or early summer, the period when apothecia are readily obtained from germinating sclerotia. Sclerotia, as has been shown, are black, shot-like bodies produced in numbers on the cankered

portions of the stem. When mature they fall to the ground, where they usually remain quiescent until the following spring. They are

in reality compact bodies composed of intricately interwoven hyphæ. From them arise under favourable conditions (in the spring, during periods when abundant moisture is present, though they are not uncommonly produced through the summer months) stalked, saucer-shaped, light-coloured structures termed apothecia. These bear on their upper surfaces numerous cylindrical sacs, each containing eight spores. These are discharged forcibly into the air and are carried to plants in the vicinity. Here, conditions being favourable, infection occurs, and a mycelium is produced, which penetrates the plant-tissues, killing them and blocking the conduction-vessels. As a result, wilt and death of the plant follows, the mycelium at the same time growing to the surface of the attacked portion, where it produces sclerotia, which eventually fall to the ground.

The disease frequently does not spread beyond these initially infected plants, its spread being dependent to a large extent on a high moisture content of the soil and vicinity. Usually, however, it spreads to contiguous plants, forming a small diseased patch; or it may spread rapidly over a considerable area, until in extreme cases all plants within an area of one-third of an acre may be killed. The manner of the spread of the disease from the initially to subsequently infected plants is not known, but, judging



FIG 3. SHOWING BLACK SCLEROTIA ON STEMS. HALF NATURAL SIZE.

[Photo by Writer.

from the number of stems infected well above ground-level, it is probable that here, too, ascospore infection is chiefly responsible.

Remedial Treatment.

Inspection of diseased plants shows that partial or complete infection of the tubers is frequent—this, of course, depending on the period at which infection occurs. When tuber-infection is severe most of them rot, sclerotia being produced in abundance on the exterior of decayed

tubers. Others may show slight infection, which often escapes notice, and it is these tubers, often with one or several sclerotia attached (frequently invident, as they are in the bases of the buds and are usually covered with earth), that carry the disease to clean land. As has been shown, once a crop becomes infected the disease persists in that crop, being carried over from season to season by the sclerotia remaining in the soil. On clean land—land out of grass—such bodies are not present; therefore it is obvious that the disease must be carried to the ground on the seed tubers when it appears in artichokes growing therein.

This knowledge enables us to prevent the disease becoming a serious trouble to those desirous of growing artichokes for pig-feed. But, unfortunately, nothing can be done to prevent infection in those areas where artichokes are already established and in which the disease is present. Therefore, when the disease is severe such areas should be abandoned and sown to grass; for when the host range of this fungus is considered it will be seen that it is unsafe for the farmer to sow on infected land for at least two seasons such crops as mangolds, peas, potatoes, &c.

When it had been determined that the disease was carried in the tuber the writer carried out numerous experiments with a view to ascertaining whether the organism could be destroyed without detriment to the tuber. Tubers were washed, and dipped for varying periods of time in mercuric-chloride solutions according to formulas published elsewhere (1) for the control of corticium-disease of potatoes. They were then planted in boxes. Results showed that artichoke tubers would not tolerate immersion in these solutions, those dipped for five minutes only in 1-1,000 HgCl_2 rotting in fifteen days after treatment. Moreover, at this strength the fungus was not killed, growth being readily obtained from sclerotia plated to media from the dipped tubers.

Further, it was found that the disease often was present in mycelial form within the tubers, being present in discoloured tissue at the ends by which the tubers were attached to the parent plant. Penetration of a fungicide through this tissue is not possible, so that, even were a solution evolved capable of killing the sclerotia on the exterior, the disease would still be carried in this diseased tissue. It was found necessary before treatment to wash tubers free from all attached earth, and it was during this operation that the stem-end diseased areas containing mycelium (and often sclerotia) of the pathogen were noted.

Thus remedial measures would consist in using disease-free tubers for planting. To obtain these it would be necessary to take seed tubers from a field in which the disease apparently was absent, to wash these free from soil, and to discard *any* showing discoloured spots. In addition it would be necessary to plant on land which had not been under swedes, turnips, mangolds, vegetables, peas, beans, garden flowers, &c., for at least two seasons previously. In fact, it would be advisable to use for the purpose ground which had been in grass for some two or three years. Although the disease has been found on such weeds as curled dock, spear and wing thistles, fat-hen, and Canadian thistle, its occurrence on these hosts in nature is so rare that

danger of infection from these sources may be overlooked, especially where lea land is to be used for planting.

Finally, farmers are warned against feeding to pigs on land in artichokes (or to be used for this purpose) diseased bulbs of swede and turnip, garden vegetables, or the like, or feeding such to pigs in pens and dumping the manure from the pens on land to be used for artichokes, for it is in this manner that infection frequently occurs.

A second possible method of dealing with this trouble has recently been brought to the writer's notice by Mr. N. R. Foy, Seed Analyst. While on a recent visit to Taranaki Mr. Foy found that certain farmers in the Eltham district were growing the pink instead of the usual white variety of artichoke, for they claimed that this variety was highly resistant to the disease. The pink variety is not such a prolific cropper as the white; nevertheless, if resistant, it is worth consideration, for it could then be more safely planted on the same land on which whites had been severely infected.

The writer is indebted to Mr. K. W. Gorringer, Instructor in Swine Husbandry, Department of Agriculture, Wellington, for particulars regarding the methods used in growing and feeding off artichokes; to Mr. N. R. Foy, Seed Analyst of this Laboratory, for particulars concerning the use of artichoke varieties in Taranaki; and to Mr. A. C. Buist, New Zealand Farmers' Co-operative Association, Ltd., Feilding, for conducting him to diseased areas in that district, procurement of specimens, and the like.

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Agricultural Legislation.—Drafts of the following Bills have been recently considered and approved by the Board of Agriculture: Fertilizers, Importation of Plants, Staining of Imported Seed, Stock Amendment, and Noxious Weeds Amendment.

HOT-WATER TREATMENT OF SEED BARLEY.

FIELD EXPERIMENTS IN CANTERBURY.

C. H. HEWLETT, Canterbury (N.Z.) Seed Co., Ltd., Christchurch.

ACTING on the advice and with the assistance of Mr. J. C. Neill, Field Mycologist, Department of Agriculture, the writer commenced in 1925 a series of experiments on a practical scale with the hot-water treatment of seed barley. The primary object of this work was to reduce or, if possible, eliminate the barley-smuts from the malting-barleys of Canterbury; but also it was hoped that the method might produce a healthier and more vigorous plant, and so improve both the quality and yield. The results of two seasons' work, presented below, though not conclusive until confirmed by further experience, are sufficiently striking to warrant publication.

Season 1925-26.

On 28th and 29th May, 1925, 100-bushel lots of the Kinver Chevalier and Plumage varieties were taken from our stock lines of seed barley, placed in special hessian bags holding loosely packed 30 lb. each, pre-soaked in water held at 80° F. for six to eight hours, and then dipped for ten minutes in water held at 127° F. On removal from the dip the bags of barley were cooled, and then emptied on to the drying-floor of a 27 ft. by 27 ft. malt-kiln and dried at 90°-100° F. for twenty-four hours, then dropped to 85-90° for a further thirty-six hours.

Samples were taken for germination, the tests being made at the Agriculture Department's Seed-testing Station, with the following results :—

Table 1.—Germination Tests

Period after Dip.	Treated Chevalier.			Untreated.			Treated Plumage			Untreated		
	Three Days.	Six Days.	Final	Three Days.	Six Days.	Final	Three Days.	Six Days.	Final	Three Days.	Six Days.	Final
Four months	% 9	% 78	% 84	% ..	% 100	% 100	% 19	% 86	% 88	% ..	% 100	% 100
Six months..	20	71	92	95	99	100	38	87	95	98	100	100

It will be seen that the treatment adversely affected the germinative vigour of the seed.

The treated seed was supplied to farmers growing barley on contract for the Canterbury Seed Co. The spring of 1925 was very cold and wet, so that sowing was greatly delayed and the soil in very bad condition. Germination on the whole was bad, and the treated grain came through so slowly that several growers ploughed up the whole or part of their treated seed. However, a sufficient area was left to demonstrate that the treated seed, though making such an apparently bad start, in the end caught up and surpassed the untreated seed both in yield and quality. Moreover, it was absolutely free from smut in a year in which smut was particularly prevalent and destructive in all

the crops the seed for which had been treated by the usual bluestone or formalin methods.

The results for the season are detailed in the following table :—

Table 2.—Yield Results.

Treated Chevalier : Yield per Acre.	Untreated : Yield per Acre.	Treated Plumage : Yield per Acre.	Untreated : Yield per Acre.
Bushels. 57·3	Bushels. 40·7	Bushels. 41·1	Bushels. 34

NOTE.—Yield figures are for firsts only; seconds not counted.

The product of the treated seed was threshed by an ordinary combine without any precautions being taken to disinfect the machine.

Season 1926-27.

Acting on the experience gained in the previous season's work, and on Mr. Neill's further work on smut-control, the time of dip was reduced from ten minutes to five minutes at 127° F., and the time of presoak from six-eight hours to five-six hours at 78° F.

Samples were taken for germination tests, with the following results :—

Table 3.—Germination Tests.

Period after Dip.	Treated Chevalier.			Untreated.			Treated Plumage.			Untreated.		
	Four Days.	Six Days.	Final	Four Days.	Six Days.	Final	Four Days.	Six Days.	Final	Four Days.	Six Days.	Final
Nine days ..	% 72	% 93	% 98	% 97	% 99	% 100	% 58	% 87	% 96	% 99	% 100	% 100
Twenty days	72	82	94	99	100	100	73	84	93	98	99	100

It will be seen the germinative vigour of the seed was much less adversely affected than under the preceding season's treatment.

The seed "direct from treatment" was sown on the Canterbury Seed Co.'s farm at Leeston, and the product was absolutely free from smut. The product of the 1925-26 crop (called "once removed from treatment") was sown on the company's farm at Leeston, and was also supplied to twenty farmers growing barley on contract for the company in the Ellesmere district. The seed was all machine-dressed; the grain-cleaning machines were cleaned out and disinfected with a strong solution of formalin, and the sowing-drills treated in a similar manner.

Details of results are given in the following tables :—

Table 4.—Yield of Seed "direct from Treatment."

Where grown.	Chevalier : Yield per Acre.	Plumage : Yield per Acre.
Canterbury Seed Co.'s farm, Leeston ..	67·84 bushels.	80·64 bushels.

NOTE.—All absolutely free from smut. Yield figures are for firsts only.

Table 5.—Yield of Seed "Once removed from Treatment" and Untreated Seed.

Ellesmere District.	Once removed from Treatment.			Untreated.			Increased Yield over Untreated.	Total Acres.
	Number of Farms.	Acres.	Yield per Acre.	Number of Farms.	Acres.	Yield per Acre.		
Chevalier ..	21	499	Bushels. 62	39	882	Bushels. 55.32	Per Cent. 12.07	1,381
Plumage ..	4	49	57.24	16	223	52.18	9.69	272
Total ..	25	548	61.57	55	1,105	54.68	12.60	1,653

The product shown in Table 5 was graded as follows:—

Table 6.—Grading of Product.

Quality.	Chevalier.		Plumage.	
	Treated once removed.	Untreated.	Treated once removed.	Untreated.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
First grade ..	96.8	81.97	94.9	62.55
Second grade ..	3.2	8.85	5.1	21.30
Under grade ..	Nil	9.18	Nil	16.15
Total ..	100	100	100	100

It was anticipated that the product of the "Once removed from treatment" seed, which latter was threshed in 1926 through an ordinary combine, would in consequence thereof be slightly reinfected, and the crops therefore not be entirely free from smut. Upon an inspection of the crops in January, 1927, by Dr. G. H. Cunningham, Mycologist, Department of Agriculture, and Mr. Neill, this forecast was borne out by the fact that while all the crops grown from "directly treated" seed were absolutely free from smut, of the crops grown from seed "once removed from treatment," threshed through an ordinary combine, only those grown by W. O. Rennie, George Osborne, and the Seed Company, comprising 87½ acres, were absolutely free from smut, the remainder being slightly infected. A comparison of the results as set forth in Table 7 are most interesting. All the crops in question were Chevalier.

Table 7.—Comparison of Results: Smut-free and Slightly Infected Crops.

Seed once removed from Treatment; threshed through Ordinary Combine.				Untreated Seed.		Increased Yield of Crops free from Smut	
Crops free from Smut.		Crops slightly infected.					
Acres.	Yield per Acre.	Acres.	Yield per Acre.	Acres.	Yield per Acre.	Over slightly infected.	Over untreated.
87½	Bushels. 69.82	411½	Bushels. 60.33	882	Bushels. 55.32	Per Cent. 15.73	Per Cent. 26.21

Yield figures for firsts only

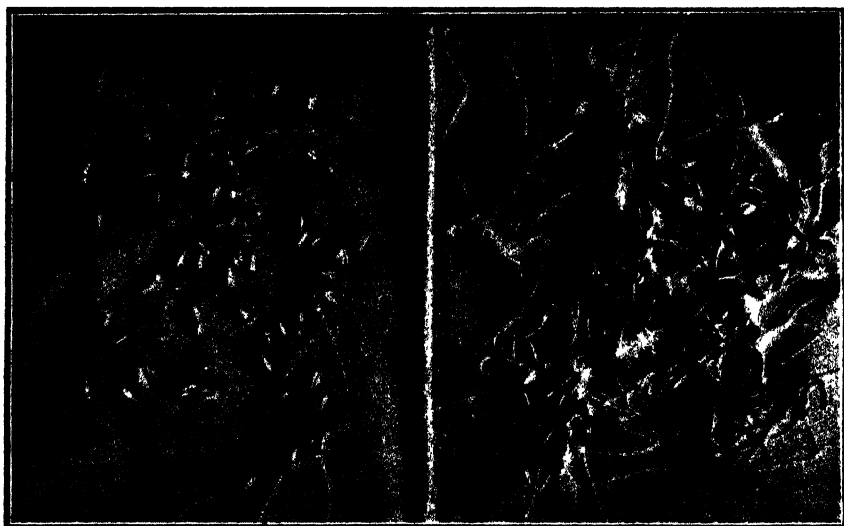
The fact that the areas free from smut yielded 15·73 per cent. more than the slightly infected, and 26·21 more than the untreated, is a point of great significance.

The results obtained so far show that the treated seed has produced an improvement both in quality and quantity.

Acting on the experience gained, and with a view to preventing reinfection when harvesting the smut-free crops of the past season, the reapers-and-binders were cleaned and disinfected with a strong solution of formalin before reaping operations commenced, and a new threshing-machine was employed to thresh the grain, the machine being thoroughly cleaned out and disinfected with formalin before threshing each separate crop.

GERMINATION OF HULLED OATS.

THERE has been some inquiry lately as to whether the hulled grains of oats germinate, the popular opinion being that they do so. Several series of tests carried out at the Seed-testing Station, Wellington, show that only a small percentage of such grains do grow. The accompanying photograph shows hulled and unhulled grains from the same sample



HULLED (LEFT) AND UNHULLED OATS UNDER GERMINATION TEST.

under test, and the difference in vitality and proportion of growth of the two types can be plainly seen. The actual result was—unhulled, 98 per cent. ; hulled, 15 per cent. It is intended to make a study at this Station of the germination of hulled seeds generally—rye-grass, cocksfoot, &c.—and the results will be published in due course.

—N. R. Foy, *Seed Analyst*.

THE PRUNING OF ORCHARD TREES.

(Concluded.)

W. K. DALLAS, Orchard Instructor, Dunedin.

PIP-FRUITS: APPLE AND PEAR.

THE bearing habit and growth of the apple and pear are almost similar, and these factors will largely dictate the style of pruning to be adopted. The fruit-bearing buds and spurs are not generally formed upon shoots produced during the past season, but are to be found developing on wood two years old and on older wood. Generally speaking, there are two types of trees—free spurring (*e.g.*, Sturmer) and lateral bearing (*e.g.*, Jonathan).

The head of the mature tree should be kept sufficiently open, so that sunlight may penetrate to all parts. The trees, without interfering with the production of good crops, should be kept in a good growing condition. The ideal bearing-tree is one that is making good growth and bearing good crops. The leaders should be kept dominant. They require to be shortened back to some extent annually, but just how far in respect to each tree is a matter which must be decided by the pruner himself. Trees which normally grow erect (most varieties of pears do) should be cut to outside buds in order to induce them to spread. For trees of the spreading habit it is recommended that the leader growth should be pruned to buds on the upper side of the shoots.

In vigorous growing trees there are usually many more laterals produced than are required, and these should be thinned out so as to avoid overcrowding. In the average good growing and bearing tree, which has been well pruned, little thinning out of laterals should be necessary. When thinning, the shorter, well-developed, mature laterals should be preserved in preference to strong, heavy shoots. In normal trees, where it is necessary to retain strong, vigorous laterals, these should be cut back to a length of from 10 in. to 18 in., according to the variety and to their position on the tree. On very vigorous trees they would require to be left longer.

In free-spurring trees the first season's laterals of normal length—10 in. to 18 in., according to variety—after being thinned out in such a manner as to provide an even distribution over the tree, may be left uncut; or, if the pruner chooses, they may be cut back so as to remove the terminal buds. It has been observed that the buds occupying positions along the middle third of the length of a lateral or shoot are the best-developed buds for fruiting purposes. In leaving these laterals uncut or by slightly shortening them the normal development of these buds into fruit-buds is not interfered with. This practice is a better means of encouraging the development of fruit-buds than cutting back laterals to four or five buds, as has been commonly practised in the past.

Second-season laterals when the pruning season comes round will have developed one or more fruit-buds, and will have made one or more extensions from the topmost buds. The practice recommended is to cut back the second-year lateral to the lower of the new laterals, which in turn should be cut back to a bud from 4 in. to 6 in. from its

base. As far as possible the cutting of the second-year lateral back to the fruit-buds should be avoided. It is desirable to leave some new growth beyond these fruit-buds for carrying foliage to provide sufficient elaborated sap to nourish the buds and fruit which may be borne by the lateral.

The third-year lateral will probably have developed short spurs as well as a number of fruit-buds. This lateral usually requires only light pruning. It should be treated in a manner similar to that of the previous year by leaving a little new growth beyond the fruit-buds or spurs. In trees such as the Sturmer, where fruit-buds develop freely, it may be necessary to thin out some of the fruit-buds in order to avoid overcropping. Weak, spindly, and surplus laterals should be thinned out.

In subsequent years the pruning will mainly consist of thinning out the fruit-spurs and fruit-buds, a shortening of laterals, and the cutting-out of injured, diseased, and worn-out parts of the trees. The trees must be kept growing moderately vigorously. The pruner is warned that trees of this habit of fruit-bearing, if not normally vigorous, will readily overbear themselves under this system of pruning unless they are carefully treated. In addition to a judicious bud and spur thinning at pruning-time, overloaded trees should be sufficiently thinned before the fruit exceeds $\frac{1}{2}$ in. in diameter. Trees showing a tendency towards weakness should be kept well cultivated and manured.

The lateral-bearing type of tree requires to be kept in a vigorous growing condition in order to produce regularly a sufficient quantity of well-matured growth. If this is done—and it is necessary that it should be in the Jonathan—very little difficulty will be experienced in successfully pruning these trees. Where necessary, the laterals should be thinned out to avoid overcrowding. All first-season laterals of normal length, about 12 in. long, which are retained should be left unpruned, as the terminal bud is usually a fruit-bud which will bear fruit during the season. Strong lateral growths which may be retained require to be cut back about one-third of their length. Occasionally fruit-buds are developed on these strong first-season shoots, and in some seasons they also develop on vigorously growing leaders. In pruning laterals on the Jonathan the pruner should cut back a lateral only to a well-developed leaf-bud or to a well-developed lateral growth. When laterals are cut back to dormant or small imperfect buds near the base these buds usually fail to respond and the stub dies.

Second-year laterals, as in the spurting type, will develop one or more fruit-buds. In the Jonathan they are the principal fruit-bearing wood. The shorter of these laterals which have made little or no extension during the past season may be left unpruned. Those which have made good growth should be cut back to a well-developed leaf-bud, or to one of the stronger lateral extensions. In order that the correct treatment may be given to the laterals before him a pruner must exercise his own judgment as to where they should be cut. Throughout the pruning of this tree it should be kept in mind that in order to maintain fruitfulness over a period of years it is necessary to stimulate new growth with which to replace the worn-out laterals. Weak, immature growth should be thinned out.

To obtain the best results with the Jonathan, which is of a spreading habit, the tree must be kept growing as directly upright as possible. Sharp-angled bends on the leader growth should be avoided, as they restrict the sap-flow. It is also essential that a sufficient supply annually of well-developed two-year-old wood should be available to maintain the fruitfulness of the tree. This growth may be obtained by judicious pruning, by a judicious thinning-out of all weak and immature fruit-buds, by the thinning of the fruit, and by cultivation and manuring where conditions render these necessary.

THE GROWTH OF PHORMIUM TENAX.

SOME FURTHER NOTES.

G. SMERLE, Kaihere, Hauraki Plains.

PHORMIUM TENAX reproduces itself in two different ways: by sexual reproduction—that is, by seed; and by vegetative reproduction—growing new fans from the old ones, and also by producing young fans from the rhizome. Fans springing up from the rhizome are much smaller when they appear than those produced from old fans, and a year or so longer is required for them to grow to a size suitable for milling.

The vegetative reproduction is the most common form in our wild-growing phormium areas. In a good soil and in good environment a fan of twelve to twenty months old will produce from one to two, and even three, baby fans. These fans, when they attain the age stated, will in turn reproduce, and so on. Nearly all fans produced vegetatively flower in the third year of their growth, and after maturing the seed the fan dies. Seedling plants which come up in wild-growing phormium areas where cattle or sheep are grazed have very little chance of growing to maturity, because the stock pull up the young plants, and in such areas regeneration by seedlings cannot take place.

Plants reproduced by vegetative means tend to weaken, and the offspring may be said to be as old as the parent plant. This is confirmed by the fact that phormium produces every third year a specially large quantity of flower-stalks. Millers call that year a "crady" year, this term apparently arising from a corruption ("koradi") of the Maori word *korari* for the flower-stalk. If every fan produced a flower-stalk every third year, then there would be every year a similar amount; but that is not the case. Carefully examining bushes in the flowering year, one finds that many year-old fans have produced flower-stalks. It is remarkable that the intensive flowering year coincides all over the North Island, and probably also over the South Island.

Seedling plants—that is, plants by sexual reproduction—are more vigorous growers and more disease-resistant than plants from old fans. For breeding new and better varieties, sexual reproduction is indispensable. Seeds sown by the writer on 5th March started to germinate on 10th April, and seeds sown on 18th August commenced

to appear on 12th October. Only a small proportion of seeds will germinate in this time; the majority will take much longer. It was noted that from seeds sown on 15th September a few germinated on 19th October, some on 25th February, and a few stragglers appeared on 17th April following. The average time for germination is from three to seven weeks, and a good germination will give 65 to 75 per cent. of seedlings.

Seedling plants kept clean of weeds and growing in good soil will produce a young fan after eight months' growth, and a year-old seedling will have two to three of these baby fans. A single two-year-old seedling plant, if planted in good soil at the right distance and cultivated, will produce from six to twenty new fans in two and a half years' time. Plants which produce many fans have narrower leaves than plants of a similar variety with fewer fans in the bush.

Dense bushes with narrow leaves produce less fibre than bushes of similar variety with wide leaves. In cultivated soil and spaced at a suitable distance a plant will produce wider leaves and of a better fibre content than in uncultivated soil. A properly grown plant will produce leaves from 6 ft. to 9 ft. high in two and a half years' time. A few of the seedling plants will produce flower-stalks in the fifth year after the seed was sown, and the young fans of that flower-stalk fan will flower in the third year after their appearance.

It will be seen that the period of growth of most fans is three years. Exceptionally, a fan grows for a longer time, even if it has sprung from an old one, but such cases are very few. The fact of the special flowering year indicates this very plainly. In the writer's previous notes (*Journal*, January, 1927) it was shown that the leaf in the fan is ready for milling in about a year's time, and that all the leaves die before they are two years old. By the hook-cutting method millers have to wait from three to four years until the cut plants attain a millable size. During this long period they lose many leaves and also many fans.

Recent experiments by the writer show that the best fibre is obtained from leaves eleven to fourteen months old. Leaves fourteen to sixteen months old (those of sixteen months being the oldest that could be used for milling for the experiment) gave coarse and rather brownish-looking fibre, and the scutched-fibre percentage was lower than that from the leaves eleven to fourteen months old. Following are the details:—

Age of Leaves in Months.	Green Weight.	Weight of Unscutched Fibre.		Percentage.	Weight of Finished Fibre.		Percentage.
	lb.	lb.	oz.		lb.	oz.	
4 to 6	18	2	6½	13.28	1	1	6.00
8 to 11	13	1	7½	11.39	0	13	6.25
11 to 14	14	1	11½	12.16	0	13	7.59
14 to 16	17	2	6½	13.56	1	4½	7.35

The hand scutching was rather severe; with an automatic scutcher the finished fibre content would have been higher. Test scutching cannot be done satisfactorily by hand. The operator always tends to scutch the experimental hanks for a longer time than the usual fibre.

SEASONAL NOTES.

THE FARM.

AUXILIARY FEEDING.

JULY is often the most severe month of winter, and one of the farmer's main cares at this period will be to see that his stock receive not only sufficient fodder to rebuild tissue but enough to maintain ample bodily warmth. It may have been found necessary to husband the hay and other forage until now, but no pinch should be allowed in July. Specially important is this in the case of pregnant ewes and cows due to calve in early spring. Scant feeding may not only impair the milk-flow of the ewe or milch cow -it may actually endanger the whole future of the offspring.

On farms where a variety of root crops are grown the swedes will be fairly well cleaned up by the end of July, and the carrots should be fed next. Carrots are ideal for cows when they first come into profit, and as they usually start a new growth about the end of August it is better to use them earlier when at their best. Mangolds will keep longer than any other root, and the longer, within limits, they are kept the better their feeding-value. For this reason they should be the last root fed in winter and early spring.

Chou moellier is now extensively grown, and there are quite large areas being saved for July and August feeding. Generally this forage is in good condition in July, but August frequently sees a new growth and a tendency to run to seed. When in this condition there is some danger of it inducing redwater if cows are turned on to the crop. At this period of the year it is safer to cut the forage and let it wilt to some extent before being fed to stock.

Feeding-off of autumn-sown cereals should be done before the crops become too rank. Generally speaking, two light feedings will be better for the crop and the stock than one heavy feeding.

PASTURE-MANAGEMENT.

Where rough feed still exists it will now be good practice to get it eaten out and the paddocks thoroughly cleaned up and harrowed about the end of July in preparation for the early spring growth. Old herbage that has stood in winter has very little feeding-value, and in the case of in-calf cows frequently does considerable harm by bringing about compaction. On the higher country where spring is late this cleaning-up may be left a month later. It sometimes happens on dairy farms where plenty of roots, hay, and ensilage are provided that difficulty is experienced in getting paddocks well eaten out. In such cases it is a good plan to either buy a few hungry store cattle for the purpose or give the grazing to some other farmer who owns this type of cattle.

Hay and roots should be fed on the poorer and older pastures, and the drier situations chosen for the purpose. This is a sure method of raising the fertility and introducing grass-seed on to bare places. The hay should be distributed across the field, so that the beneficial effects may be well spread. Exception can be made in the case of patches

which are infested with grass-grub, on which the feeding-out may be concentrated. The incidental consolidation and reseedling will be found useful in controlling this pest.

Tripod harrowing is one of the cheapest and most profitable operations on the farm, and there are few better ways of utilizing days when other work cannot be undertaken. The maintenance of a good pasture depends on a healthy root-system, and letting the air into the turf is of great importance in promoting this condition. Although chain harrowing is useful for the spreading of animal-droppings, it is of little value for surface cultivation, and the majority of our old pastures need far more drastic treatment than they are now receiving. The best time for doing this work is when the ground is moderately damp or during showery weather.

Rolling, especially on light land, will benefit young grass, but this operation should not be carried out on a frosty morning.

Any top-dressing still to be done should now be pushed on, so that all such manuring for this season may be finished by the middle of August. It is satisfactory to note that most grassland farmers are taking advantage of the present low prices of phosphatic fertilizers to largely extend their top-dressing. The average farmer cannot afford *not* to top-dress.

SEED PEAS.

Ground being prepared for commercial crops of seed peas should be well cultivated throughout July and manured. In localities where late frosts are not generally experienced, early sowing—about the last week in July—is advantageous.

—*Fields Division.*

THE ORCHARD.

PRUNING.

THE most important work at this period of the year is pruning, which in all the larger orchards should be pushed on as fast as possible, so that it may be completed before the trees break into growth in the spring. The special article on pruning commenced last month is concluded elsewhere in this issue of the *Journal*. It may be added that the larger wounds should be cut smooth with a sharp knife and then given a coating of paint or tar, in order that the cut surface may not be exposed to the attack of fungi. All prunings, large and small, should be gathered and burnt as soon as possible, so as to minimize the spread of disease.

GRAFTING AND BUDDING.

Trees which it is intended to bud in the spring may now be cut down to within 2 ft. of the position at which it is intended to insert the grafts. A clean, fresh cut should be made at the time of grafting. It is generally advisable to graft the older trees about 6 in. to 12 in. above the point where the limbs fork. Stone-fruit trees which it is intended to bud in January or February should be cut back to just above the forks, so as to induce suitable new growth for budding into.

CULTIVATION.

Ploughing may be carried out where the land is in a suitable condition, and should be completed as early as possible. A depth ranging from 3 in. to 8 in., according to the age of the trees and the depth of the roots, is usually sufficient to turn in and cover the weeds or green crop. When ploughing close up to the trees the depth should not be greater than from 3 in. to 4 in.

MAINTENANCE OF PLANT.

During the winter months advantage should be taken of wet days to clean, oil, repair, or paint harness, tools, and implements, &c. The spray-pump should be the first to receive attention, and the whole outfit should be thoroughly overhauled and put in good working-order. In localities subject to heavy frosts no liquid should be left in the pump, otherwise the latter may be seriously damaged.

HARES AND RABBITS.

These animals sometimes cause considerable damage to young trees at this time of the year. In localities where they are present the orchard should be netted in. All netting fences should be examined carefully, and any holes which may be found repaired at once, at the same time clearing out any of the pest which may be in the orchard. Where netting is not provided the trees should be securely bandaged with newspaper or painted with a mixture of oil and horse-manure. The oil mixture is usually effective from three to five nights, and it is necessary to renew the application at intervals until all danger is past. On laterals and young branches or leaders the oil should not be stronger than 1 in 4.

FRUIT IN STORAGE.

Fruit in cool and ordinary storage should now be examined at frequent intervals. Apples should be disposed of while sound and in good condition, and before they show any sign of shrivelling or become overripe. Overmature fruit will not stand the handling that freshly picked fruit will, and frequently arrives on the market in an unsaleable condition. Pears should be disposed of before they become too yellow and ripe. All stored fruit should be repacked before it is placed on the market.

SPRAYING.

Experience has shown that what is termed winter spraying is usually best delayed until early spring. In circumstances where it may be considered advisable, however, a heavy winter dressing of an insecticide or fungicide can be applied.

—W. K. Dallas, *Orchard Instructor, Dunedin.*

Citrus-culture.

It is far too general at this period of the year to find the citrus-groves overgrown with weeds and misplaced planted cover-crops. Although it is desirable to allow a wealth of green stuff to grow, to be later turned under, this growth should be controlled. If allowing vegetation to

grow means that the soil becomes sour it is best to choose the lesser of two evils and turn the land over in order to allow excess water a chance to dissipate. The same amount of humus may not be added to the soil, but lack of humus is preferable to excess moisture. Where the land is well drained and a heavy cover-crop allowed to grow, this should still be controlled to the extent of keeping the area immediately under the tree in a state of clean cultivation. Neglect of this results in loss of soil-sweetness, with a consequent setback to the tree. Excessive weed-growth also often results in the softening of trunk-bark to an extent which leaves it less resistant to the various forms of rot that readily attack that part of citrus-trees.

Pruning: Some pruning will be required among lemons, where growths from 3 ft. to 4 ft. in length of an extended unfurnished nature are often found. These were made during the past autumn, and will naturally divide at the tips towards springtime if left uncut, giving the tree that form of straggly growth so difficult to deal with later without loss of crop. These long shoots should be pruned now to about half-length; they will then give rise to side growths of a good fruiting habit where required by the grower. It is possible that if all such long shoots are so treated the tree will become too bushy and compact. In this event only the required number for which good space can be found should be allowed to remain.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

THE BREEDING-PENS.

THE season has now arrived when the breeding-pens should be mated up. This is one of the most important phases in the poultry-keeper's year. It is, indeed, a time when his judgment is put to a severe test—that is to say, if the good qualities of his stock are to be improved or maintained. In the work of selecting the breeding-birds the first essential is to have purebred stock to select from—good specimens of the breed they represent. Therefore, if any real advance is to be made in holding the good qualities of a flock, the poultry-keeper must necessarily have a knowledge of the standard requirements of the particular breed or breeds he is working with. In order to become familiar with the various standard types of the most useful and popular breeds of poultry the novice cannot do better than study closely the plates, together with the text describing the breed characteristics, in the Dominion Utility poultry Standards. Copies of this booklet are obtainable from the Publisher, Department of Agriculture, Wellington, at a cost of 3s. each, postage free.

It is pleasing to notice that utility poultrymen are now taking a greater interest in the poultry shows of the Dominion. It is to be hoped that the show movement will rapidly spread and increase in importance, as this is practically the only means we have of preserving in a state of purity the many useful and beautiful breeds of poultry that are at our command. One of the greatest mistakes made in the past was to assume that because a bird was built on utility lines it could not be a good specimen of the breed it represented. The old

practice of treating phenomenal egg records, the width of the pelvic bones, &c., as the chief qualification of a breeding-bird—which practically meant the ignoring of breed characteristics—is fast passing away. On most successful plants more attention is now being given to the maintenance of breed-type than ever before. Beauty and usefulness are not inseparable, but in the absence of show competition this fact is apt to be ignored, if not lost sight of altogether. Of course, a first cross—that is to say, the progeny of two pure breeds—will sometimes give good results, but it is yet to be proved that from a general standpoint such stock are more profitable than stock bred in a state of purity. If any argument is required to bear out this contention it is surely conveyed by the high egg records produced by purebred stock in the egg-laying tests. In any case it takes two pure breeds to produce a first cross.

Having purebred stock, the next great essential is points indicative of constitutional vigour. It cannot be expected that a bird bred from a weak parent will have the stamina to withstand the great strain on the body which heavy egg-laying entails, nor have the power to digest and assimilate the food necessary for the production of a large number of eggs. Profitable production implies profitable stock, and the securing of this rests chiefly on the class of stock mated. Many poultry-keepers, especially farmers, make the common mistake of using eggs for hatching purposes from the whole of the flock, whether the birds be good, bad, or indifferent. Such a practice soon leads to deterioration of a flock, however well they may be bred. If a flock is to be built up and maintained, nothing but specially selected birds should be bred from. Just as the dairyman selects or rejects his cows from a breeding standpoint on the quantity of butterfat they produce, so must the good layers (also possessing the other necessary breeding qualifications) be selected in the case of poultry. This means the necessity of a breeding-pen and mating the best specimens by themselves. No poultry plant is complete without a breeding-pen. It must always be remembered that it is more profitable to have, say, one hundred pullets bred from specially selected stock than double the number bred from indifferent stock.

General Appearance.

As a guide to the novice the following points may be mentioned as indicative of strong constitutional vigour in both sexes. A clean face free from wrinkles and feathers, prominent bright eye, short stout beak, legs set wide apart, short shank, tight feathering, and a well-developed crop. Hand-in-hand with these points should go signs suggestive of laying-power, such as a long deep body, and a well-developed abdomen, soft to the touch, surrounding the abdominal region. In addition, the back should be broad, while generally the bird should present an alert, businesslike appearance. Birds with coarse heads, long thin beaks, heavy feathered eyebrows, dull sunken eyes, and wrinkled skin surrounding the eye, usually indicate poor egg-capacity and low vitality, and obviously should not be bred from.

As to size, it is now generally recognized that the medium-sized bird of its breed is the best layer. It should, however, be clearly understood that the most productive hen is not necessarily the best bird to breed from. The danger of improving one character by weakening

another should always be kept in mind. It is always advisable to choose for the breeding-pen the hen of a slightly larger size than that of the ideal layer: this for the reason that when breeding for heavy egg-production there is always a tendency for the stock to decline in weight rather than to increase. In short, the small individuals will come soon enough to vex the breeder even when nothing but large specimens are bred from.

Size of Eggs.

Another important qualification in the breeding-hen is that she be a layer of good-sized marketable eggs. As things point there is every reason to believe that in the near future our eggs will have to face keener competition on the oversea market than has been the case in the past. To meet this growing competition nothing less than a 2 oz. product is required. On the local market, where there is no outside competition, and under the present system of selling by count, an egg scaling $1\frac{3}{4}$ oz. realizes as much as one of 2 oz. or more. On the London market, however, it is entirely different. Eggs are paid for not only according to their internal quality but their weight as well; and the sooner this fact is realized by the producer the sooner will the export trade be placed on a sounder footing. The fact of having to include a $1\frac{3}{4}$ oz. product in export shipments (as was the case last year) in order to remove the small existing surplus beyond local requirements is sufficient to indicate that the matter of small eggs is one of the most important problems to be solved if maximum returns are to be secured from the export trade. The weak argument used by those who favour shipping the $1\frac{3}{4}$ oz. product is, "We are going to sell our eggs at a price f.o.b., and if the grade suits the buyer nothing more is required." Be this as it may, the fact remains that if the size of the eggs were consistently increased the price would be increased accordingly. After all, if a sound export trade is to be built up and a keen demand created for New Zealand eggs, it is the quality that appeals most to the oversea consuming public (not necessarily the speculator) which calls for first consideration; and it is certainly not the egg weighing less than 2 oz. that will appeal most in catering for the high-class trade.

The existing problem of the small egg can be solved only by breeders taking greater care in the selection of their breeding-stock as well as the eggs intended for incubation purposes. This implies the elimination of diminutive specimens of their breed from the breeding-pen, and using no egg for hatching purposes under 2 oz. in weight.

The Male.

In the mating of stock the male bird has an important bearing—he is more than half the flock. He should, above all things, possess signs of undoubted constitution. Further, he should be the son of a healthy mother with a record of egg-laying performance behind her and a producer of first-grade eggs. He should also possess strong masculine characteristics by being stouter and more cobby than the female. The hen should be feminine in all respects. The feminine-looking male or the masculine female should never be bred from.

MANAGEMENT OF BREEDING-STOCK.

The proper feeding of the breeding-birds is all-important if success is to be assured in the hatching and rearing of the progeny. They

should be put on a special diet. This should be plain, as on no account should the birds be forced for heavy laying; rich food such as meat, milk, &c., should be sparingly provided. The best plan is to supply at all times a mixture of any grains, such as wheat, maize, oats, &c. In fact, the greater the variety of grains fed the stronger will be the hatching-qualities of the eggs, and the easier will the chicks be to rear. The food should be fed in deep litter to induce exercise, this being essential if the birds are to be maintained in a proper breeding condition.

— *F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

WINTER INSPECTION.

THE management of the apiary at this season consists chiefly in making an occasional round among the bees to see whether anything has gone wrong with them. On no account should they be unnecessarily meddled with. Where any doubt exists as to the stores required for wintering it may be necessary to open the hives. However, it is by far the better practice to try and estimate the quantity of stores on hand by lifting the back of the hives. Experienced beekeepers can in this way gauge by weight the stores present. Inexperienced beekeepers will, of course, have to examine the combs. If it is necessary to do so, choose a fine day, and in any manipulation that follows on no account break up the cluster of bees. After examination, close up the colony as soon as possible in order to conserve the heat. If a colony is found deficient of stores, a comb or two of honey or a cake of candy laid on top of the frames over the cluster will help considerably. At this season of the year bees will not take syrup readily. If combs of honey are on hand and feeding is carried out, place the combs on the outside of the cluster. To place them in the centre of the cluster will be the means of dividing it, and this will result in much harm to the bees and probably bring about their death.

MATS AND COVERS.

After heavy rains it is well to examine the mats over the frames. If any damp ones are found, replace with dry ones. A supply of mats should always be on hand. It will only be necessary to gently lift one end of the cover to discover the condition of the mat, and this can be done without disturbing the bees.

All covers that are not absolutely rainproof should receive attention. No better covering for roofs can be had than sheet lead. Such covers are costly to commence with, but are rainproof and do not require to be secured in windy locations. If found too expensive, cover the roofs with zinc or ruberoid. If the latter material is used it should be heated before being fixed to the roofs.

REMOVING SPARE TOP BOXES.

All the top boxes that have not yet been removed should now be taken off and the bees confined to the brood-chambers. Breeding will

commence shortly in colonies of normal strength in the warmer parts of the Dominion, and the hives should be made snug with well-fitting mats to conserve the heat of the hives. If it is found that the bees have taken to a top box entirely, remove the lower one and put the former in its place.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

PRODUCE IN STORAGE.

POTATOES, onions, and other produce in store are frequently seriously depreciated by neglect, particularly when careful grading has been omitted. A thorough examination of the condition of such produce should be made from time to time so that it may be marketed without loss. Any dampness or heating will quickly cause sprouting and decay, but this may be avoided by suitable ventilation and drying. The danger of heating is greater where large bulks are stacked in a compact manner. If tipped into bins they should not be very deep, and if the store is small, with comparatively little air-space, the more ventilation will be required.

VEGETABLE CROPS.

Spring cabbage and cauliflowers planted out towards the end of autumn will now commence to renew their growth, and will require hoeing in fine weather to check the competition of weeds. When some growth has been made they may be judiciously fed with fertilizers now and again, as required to produce the crisp vigorous qualities that are desirable in these crops. Where autumn-sown peas are grown they will require somewhat similar attention.

The preparation of the lighter and warmer land for the early and also the hardier main crops should now be completed by occasional cultivation when dry, in order to clean the ground by sprouting and destroying the seeds of weeds. During the coming month the main-crop cabbage, cauliflower, lettuce, and onion plants sown in late autumn may be planted out on such lands. In most instances a moderate dressing of suitable fertilizers should be worked in with the cultivator a short time before planting.

Shallots, garlic, and artichokes may also be planted. Broad beans, peas, spinach, and main-crop cabbage and cauliflower seed may be sown when the conditions are suitable.

Where the practice of sowing the onion crop in spring is adopted, the earliest opportunity of carrying out the work should be taken. By doing so the bulbs are well forward before the period when the more serious fungus blights are prevalent, and they may also be harvested to greater advantage during the warmer months.

CROPS GROWN UNDER GLASS.

Another season now commences in this section with the sowing of tomato and cucumber seeds for planting out under glass towards the end of August. Next in importance to seed strain is the need of

growing plants that are of good, strong texture. This condition is obtained chiefly by growing them steadily from the start. Rapid growth is apt to be very encouraging to the grower, but the satisfaction is entirely misplaced, as such a plant will be seriously checked when planted out, and will take valuable time in making a recovery. There is hardly any exaggeration in stating that temperatures too high are as serious as those which are too low, yet this is rarely realized. The ventilation of the house is best left to one person, who will get accustomed to its working. A temperature of 55°-65° F. is best for tomatoes, and a slightly higher range for cucumbers. If the temperature is inclined to exceed the maximum, ventilation must be given to steady it. By such means, and the use of water of about the same temperature as the glasshouse, the desired type of plant may be grown, and early fruit which secures the higher prices is obtained.

It is also time to complete the preparation of the glasshouses in which the plants are to be planted out. It is necessary that the houses should be thoroughly cleaned, and the land given the requisite amount of cultivation and manures in time for it to consolidate into a firm condition. Houses that have been kept close and allowed to become very dry will require to have the ground thoroughly saturated with water, so as to bring the soil back into a state of fertility.

Some unheated houses that were subject to damage by spring frosts were successfully brought through the danger period last season with the assistance of electric radiators. The wires were piped along the apex of the roof with plug sockets placed at intervals. Half a dozen small radiators are quickly placed into position by means of plugs and cords, and just as quickly removed and stored away when the need for them passes. This method has given excellent results, and with a clocked switchboard the current may be obtained at night, when it is most required by the grower, at a reduced rate that is reasonable for the service obtained.

SEASONABLE WORK IN THE BERRY BRAKES.

With the greater demand for berry fruits, there is an increased interest being taken in the growing of currants, gooseberries, raspberries, loganberries, and strawberries, and some very fine work is being done. There is, however, much room for improvement in many gardens in the way of pruning, spraying, and feeding. Attention to these matters now is the best way to avoid the melancholy study of disease when a heavy crop should be ripening. There is no method of growing good crops continuously without careful attention to these matters. Neither is it satisfactory to prune the bushes and set a heavy crop unless manures are given to enable the plants to develop the berries.

After pruning, manures may be applied and ploughed in, and the early flowering kinds given a good application of a carefully prepared bordeaux spray.

TOBACCO BARNs, SEED-BEDS, AND FIELDS.

In the barns the baling and despatch of cured leaf will now bring the season to a close. Handling dry leaf and packing slack bales are two points to be carefully guarded against. Leaf so packed is almost a total loss after transportation. While the leaf-stems must be thoroughly

dried out, the blade of the leaf must contain sufficient moisture to allow it to be handled without breakage. If it is then firmly packed into bales with the help of a press it will arrive at its destination in creditable condition. Presses need not be elaborate or expensive, although such may be a convenience where a great deal of work has to be done with them.

As the first seed-beds for the new season are made during the month of August, it is already time to commence the necessary preparation. While it is desirable to have the beds near the homestead to facilitate the necessary supervision, care must be taken to avoid fouling the land with tobacco-diseases by successive sowings in the same place without sterilization; even with it the land is often impoverished by loss of humus and other properties. No precaution should be neglected to secure early, healthy plants. The site for the seed-beds must be warm and sheltered, and the soil well drained. Where it is decided to sterilize the top soil, the method of the Maori kumara-cultivators may be adopted. Brushwood is piled to a depth of 3 ft. to 4 ft. and burnt, thus heating the soil sufficiently to a depth of a few inches to destroy organic life. The land in this case is afterwards given only a shallow cultivation of 3 in. or 4 in., so as to retain the treated soil. In some localities glass sashlights would be of value for the protection of this first sowing.

The necessary seed should be obtained now, if it is not already in hand, and care taken to get the best quality of a suitable variety. It is also desirable to test it for germination, so that it may be sown as thinly as possible. Seed should also be obtained from clean plants, as plants readily carry some serious diseases. A teaspoonful of average seed will sow 10 square yards—sufficient plants for an acre of land; and an ounce is sufficient seed for plants for 5 or 6 acres.

The field in which the plants are to be placed also requires consideration. The selection and preparation of this land is often left until it is too late to be effective, and then the cutworm pest is bad and constant weeding is required. An early light ploughing to allow all grass and weeds to decay is often good preliminary treatment, to be followed, when that is accomplished, by a second ploughing that is rather deeper and crosswise. The most suitable land for the tobacco crop is a friable soil of fair quality, well drained, and lying in a sunny position well sheltered from prevailing winds, which do serious damage by bruising and tearing the leaves.

—W. C. Hyde, *Horticulturist*.

Honour for Dr. L. Cockayne.—Another scientific honour has been conferred on our esteemed contributor, Dr. L. Cockayne, F.R.S., of Wellington. At the last annual meeting of the Botanical Society of America he was elected a corresponding member of that body. During the twenty years of the society's existence only fifteen such memberships have been accorded by it throughout the world, including four in the British Empire, Dr. Cockayne's being among the latter.

Destroying Californian Thistle.—Small patches of Californian thistle in a fairly clean grass-paddock may be killed out by sinking a post firmly in the middle of the patch. The cattle, rubbing themselves on the post, will tramp the surrounding ground bare. Another similar method is to place a lump of rock salt on the patch.

WEATHER RECORDS: MAY, 1927.

Dominion Meteorological Office.

GENERAL SUMMARY.

MAY is regarded as the last month of autumn, and was this year rather cooler and more changeable than usual—in fact, the last week may be described as the commencement of winter.

While the first part of the month was dry and the days sunny, yet the earth radiated its heat at night so that there were several severe frosts. On the 12th 20 degrees of frost were registered at Hanmer Springs; and earth-temperatures were generally lower than the average. These frosts did not occur in the cold and wet weather at the close of the month, the clouds then blanketing the earth and the rainfall distributing a certain amount of latent heat. There was, however, on the morning of the 31st a frost of 14 degrees at Christchurch, which is the lowest temperature on the grass ever recorded there in May.

Rainfall was below the average in Otago and South Canterbury and between Farewell Spit and Westport in the South Island, and in Hawke's Bay and Poverty Bay in the North Island, but was considerably above the average in most other parts of the country. Rainfall was particularly heavy about the 26th, 27th, and 28th, when a westerly storm area combined with a disturbance from the north. Total rainfalls at some of the stations were as follows: Arthur's Pass, 17·85 in.; Otira, 20·92 in.; Greymouth, 10·59 in.; Ross, 15·33 in. In the far North, Puhipuhi Plantation had an unusually heavy total of 12·59 in., and Waihi registered a total of 10·89 in. for the month. On the other hand, Christchurch was 80 per cent. and Waiau 85 per cent. below the mean for the month.

There were several windy periods, but on the whole the month was fairly calm. Except in the dry areas there was a good growth of autumn feed.

RAINFALL FOR MAY, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
<i>North Island.</i>				
	Inches.		Inches.	Inches.
Kaitaia	4·98	9	1·86	5·06
Russell	6·78	14	1·78	5·15
Whangarei	7·05	10	2·36	6·70
Auckland	5·48	18	1·96	4·50
Hamilton	6·13	21	2·42	4·54
Kawhia	7·24	18	1·74	4·77
New Plymouth	6·61	19	1·34	6·15
Riversdale, Inglewood	12·19	18	2·81	9·82
Eltham	7·57	16	2·42	5·27
Whangamomona	8·31	17	2·83	6·59
Tairua	6·18	17	2·62	6·11
Tauranga	5·32	14	1·79	5·16
Marachako Station, Opotiki	7·02	9	2·66	5·70
Gisborne	3·43	16	0·97	5·67
Taupo	6·19	10	2·17	3·60
Napier	2·92	14	1·03	3·74
Marakakaho Station, Hastings	2·31	14	0·61	3·52
Taihape	3·71	15	0·85	3·84
Masterton	4·07	15	0·96	4·03
Patea	5·87	15	1·60	3·91
Wanganui	3·13	10	0·69	3·42
Foxton	6·40	10	1·36	2·78
Wellington	5·77	13	2·75	4·76

RAINFALL FOR MAY, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average May Rainfall.
<i>South Island.</i>				
	Inches.		Inches.	Inches.
Westport	6.50	15	1.12	6.58
Greymouth	10.59	15	2.58	8.01
Hokitika	13.99	12	3.71	9.71
Ross	15.33	11	4.15	9.73
Arthur's Pass	17.85	13	3.50	11.02
Okuru, Westland	16.39	16	2.77	11.60
Collingwood	8.12	15	1.49	10.18
Nelson	3.65	8	1.07	3.08
Spring Creek, Blenheim	3.37	6	1.90	3.19
Tophouse	7.08	12	2.65	5.94
Hanmer Springs	3.48	10	0.85	4.47
Highfield, Waiau	0.50	5	0.16	3.41
Gore Bay	1.25	6	0.60	3.83
Christchurch	0.53	8	0.21	2.65
Timaru	0.50	5	0.26	1.41
Lambrook Station, Fairlie	0.54	5	0.18	1.53
Benmore Station, Clearburn	1.29	9	0.54	1.75
Oamaru	0.83	5	0.47	1.61
Queenstown	2.11	10	0.70	2.63
Clyde	0.70	6	0.22	0.97
Dunedin	2.29	10	1.20	3.23
Wendon	1.61	9	0.66	2.31
Gore	1.63	15	0.58	2.71
Invercargill	2.70	19	0.42	4.46
Puysegur Point	9.10	17	0.78	6.81

—D. C. Bates, Director.

WHEAT AND OATS THRESHING RETURNS.

RETURNS of actual threshings received by the Government Statistician up to 19th May from threshing-mill owners showed that until then totals of 5,436,622 bushels of wheat and 2,937,341 bushels of oats had been threshed out. The average yield per acre in cases where particulars of areas were furnished (covering 99 per cent. of total threshings) worked out at 38.02 bushels for wheat and 43.25 bushels for oats. The figures for the Canterbury, Otago, and Southland Land Districts respectively were as follows: Canterbury—Wheat, 4,543,938 bushels threshed, averaging 38.43 bushels; oats, 1,640,513 bushels threshed, averaging 42.06 bushels. Otago—Wheat, 715,293 bushels, averaging 37.68 bushels; oats, 696,868 bushels, averaging 47.18 bushels. Southland—Wheat, 18,177 bushels, averaging 35.67 bushels; oats, 468,465 bushels, averaging 44.87 bushels per acre.

PRECAUTIONS AGAINST FOOT-AND-MOUTH DISEASE.

FULL information was placed before the Board of Agriculture at its last meeting in regard to the incidence of foot-and-mouth disease in Europe, and the regulations made for the prevention of the introduction of the disease into the Dominion were reviewed. The Board decided that it could not recommend any relaxation of the regulations except in so far as the importation of cattle from the Island of Jersey was concerned. Jersey still enjoys freedom from the disease, and in the circumstances the Board decided to recommend that cattle be allowed entry from there, provided arrangements can be made for them to be transhipped in open water without landing in Britain.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

RABBIT-POISONING WITH PHOSPHORIZED POLLARD.

J. F. C., Rangataua :—

I should be glad to know (1) the best time for poisoning rabbits with phosphorized pollard ; (2) whether it is safe to lay the poison in the same paddock with sheep, and, if not, how long should the paddock be left empty ?

The Live-stock Division :—

(1) The best time to poison varies in different parts of the Dominion. In your locality the best time for winter poisoning is during June and July, and for summer poisoning in February and March. It does not follow, however, that successful phosphorized-pollard poisonings are not obtainable at other periods. Many settlers successfully patch-poison their lands throughout the whole year, and, if rabbits are increasing, a poisoning between the winter and summer is often necessary. (2) While, in most cases, poison can be safely laid in large paddocks in which sheep are running, it is always advisable to act on the rule that "prevention is better than cure," and to remove the sheep while poisoning is being done, leaving the paddock empty for about a month, unless in the meantime good rains have destroyed the poisoned baits. In small paddocks it is in all cases advisable to remove the sheep when poisoning ; and if the poison is laid in a plough-furrow or on sods in well-defined lines that which has not been taken by the rabbits can be picked up or covered over after the lapse of a fortnight or so, after which the sheep can be turned on again.

GERMINATION OF TREATED SEED WHEAT WHEN SOWING DELAYED.

"WHEATGROWER," Methven :—

Will you please inform me to what extent germination of wheat is affected by (1) formalin, and (2) the usual bluestone mixture, if the grain has to be kept (owing to break in the weather, for instance) a week or a fortnight, or even longer ? I am told that not more than 25 per cent. will germinate after forty-eight hours if pickled with formalin.

The Fields Division :—

(1) Formalin : The germination of formalin-treated wheat is undoubtedly lowered by each day's delay in sowing, but the actual amount is dependent on several factors. (a) The drier the treated wheat becomes, the greater the loss in germination. Your informant is right that germination will probably be reduced by 75 per cent. in forty-eight hours if the treated wheat becomes thoroughly dry and the atmospheric humidity is low, or if it is sown in dry soil. If kept moist and sown following rain the loss due to the treatment will not be so severe ; but moulds grow well on formalin treated seed and will severely injure it if kept more than a few days in a damp condition. (b) Farmers as a rule use an overconcentrated formalin solution, which materially increases both the initial damage and the loss on keeping. A strength of 1 pint of commercial formalin to 60 gallons of water (1-480) is recommended. (c) Wheat that is low in vitality, or that has been severely handled during threshing, is very liable to injury following formalin treatment. (2) Bluestone : The "usual" bluestone treatment is, like that of formalin, far too strong and does much unnecessary damage. A solution-strength of 1 lb. bluestone to 10 gallons water is quite sufficient to control stinking-smut. Deterioration of wheat after treatment at this strength is not so rapid as with formalin, nor is the grain materially affected by drying—the actual loss in any particular case depending on the condition and variety of the seed.

PERIOD OF HEAT IN EWES.

J. DRIVER, Okoia :—

I have been asked several times lately how often a ewe comes on heat—or, rather, how long there is between the periods, assuming she is not in lamb. I should be obliged if you could give me information on the subject.

The Live-stock Division :—

Sheep, unlike other domesticated animals—for example, the cow—do not have regular periods of oestrus (heat). Desire for the male usually shows about March, lasts for a few days, and, if not gratified, reappears a few times at short intervals. Presence of the ram among the ewes earlier in the season will bring on oestrus at that time. When in season, a slight discharge from the vulva is noticeable.

SYSTEM IN MANURIAL TOP-DRESSING OF GRAZING-COUNTRY.

“BASIC SUPER,” Waipukurau :—

I should be glad of an opinion on the following case : A man owns 1,000 acres of second-class land ; the grass consists mostly of agrostis and danthonia, and carries about a sheep to the acre, with some cattle to keep the roughage down. The place is not overstocked, but the sheep are not thrifty. The property has been in grass for a great many years. The owner intends to try top-dressing, but is not in the position to spend large sums this year. Would it pay him best to concentrate on one paddock, or to divide his manure among a number of paddocks—top-dressing certain portions of them, to enable all the sheep on the farm to get some phosphate, which, it is plain, the land is lacking in ?

The Fields Division :—

It is noted that apparently only a very limited amount is to be expended in manure. It would certainly be unwise to treat only portions of a number of paddocks in the endeavour to reach all the stock with some phosphate. Such a method would make it impossible to control the grazing and proper management of the untreated areas in each paddock. The landholder should concentrate with manures on one block at a time, extending to other blocks as early as opportunity permits ; and care must be exercised not to miss any portion of a block, otherwise the effect would be to draw stock away from untreated portions. The management in shifting stock from time to time would permit of distributing the effects of the phosphate on the block being treated. Such an area would be particularly useful for rearing hoggets.

PIG-RAISING POINTS.

C. W. COWAN; Ruatorea :—

I propose to fatten pigs, and would be glad of advice. I will have about 30 gallons of milk daily, and am putting in 2 acres of lucerne, and will have another 2 acres of rough pasture for them to run on. For late autumn feeding I am putting in 1 acre of artichokes and 1 acre of maize. The land is good, and will grow good lucerne and maize and artichokes. I propose buying weaners in September. Kindly inform me—(a) How many weaners it would be advisable to buy to do well and fatten ; (b) how long I should have to keep them to attain, say, 140 lb. ; (c) what would be a good ration of meal to the foregoing ; (d) is it advisable to feed skim-milk warm, twelve hours old, or sour ; (e) when to plant artichokes to be fed off about 1st April.

The Live-stock Division :—

In the first place, we may state that it would be more profitable to breed your own pigs than to buy weaners. Taking your queries seriatim : (a) The acreage mentioned for lucerne, maize, artichokes, and skim-milk should provide sufficient food for five good breeding-sows and their progeny, while if your crops are good it would probably carry more ; if possible, the sows should be purchased before the spring, but if they are not obtainable you should procure and carry on with about fifty weaners till February, and then forty more through next winter. (b) It

takes about five and a half to six months to produce pigs weighing up to 140 lb. and 150 lb. dressed weight. (c) A good ration comprises green lucerne, milk, and maize (grain) from 1 to 3 per cent. (d) It is best to feed skim-milk a few hours after separating—not sour. (e) Artichokes are planted in early spring, and are well matured for feeding off as from June; early April is too soon to commence feeding artichokes, as at that time of the year you should have some green feed available, such as maize, millet, or rape.

ARTICHOKE TUBERS FOR SEED.

HARRISON AND SAUNDERS, Marua :—

We have a small area of Jerusalem artichokes which it is our intention to keep for seed for the coming season. Should we remove the tubers from the ground when the tops are thoroughly withered, or allow them to remain till the planting season? If digging is advised, what is the best method of storing the seed? What is the correct time for planting, also best manurial dressing? The land is heavy, with clay subsoil, and somewhat wet.

The Fields Division :—

It is best to leave the seed in the ground until you are ready to plant next season. If the tubers are raised and stored they are inclined to go soft. The best time for planting is when the danger of frost is over, which in your district probably is fairly early in the spring. The following manurial mixture should give good results: Superphosphate, 5 parts; blood-and-bone, 3 parts, 30-per-cent. potash salts, 2 parts: total, 10 parts—using 4 cwt. to 6 cwt. per acre. The soil you mention is not the most suitable, as artichokes do best in soils that suit potatoes. You should endeavour to make the heavy clay more friable by ploughing in a green crop such as oats or mustard. The drainage should also be improved.

ORCHARD SPRAYS AND LIVE-STOCK.

S. J. V., Wanganui :—

I have an orchard of approximately $\frac{1}{2}$ acre, and am thinking of running two breeding-sows permanently on this piece, but there is the question of spraying. Should I be justified in keeping the sows there during spraying-time? Have you any records of stock-poisoning by lime-sulphur or arsenate of lead? Can you advise any substitute for arsenate of lead for codlin-moth?

The Live-stock Division :—

You would not be justified in keeping the sows in the orchard during spraying operations. Both arsenic and lead are deadly poisons, also any combinations of the two. Cases are on record in which cattle have died from the ingestion of grass on which arsenate has been spilled; also with cattle allowed to remain in a paddock in which blackberry was sprayed with arsenate. The Horticulture Division advises that at present there is no effective substitute for arsenate of lead for controlling codlin-moth or other caterpillars on fruit-trees.

DESTRUCTION OF "NATIVE HEATHER."

H. SMITH, Pongaroa :—

Could you give me any advice on eradicating the serious weed known in this locality as "native heather"? I have tried the only means within my knowledge—grubbing, and then burning and crushing with cattle. Both ways are expensive, and so far by no means permanently effective.

The Fields Division :—

Up to the present no practical method of destroying the scrub commonly known as native heather (*Olearia solandri*) is known, other than grubbing and burning as you are doing. This plant is common on many of the poorer types of soil, which makes the position all the more difficult, as the expense of grubbing, &c., is recurrent.

CLEARING OF MANUKA.

F.A., Ashhurst :—

I am having cut small patches of manuka that is making its appearance in some of the paddocks. As there seems to be a difference of opinion as to after-treatment, I should be glad of advice as to burning or not.

The Fields Division :—

Whether the cut manuka should be burned or not depends on its density. If after chopping it is dense enough to carry a good hot fire it is advisable to burn. The approved method is to chop manuka during late winter or spring and let it lie until autumn before firing, thus encouraging as far as possible the germination of seed previously dropped. It is considered that a good hot fire will destroy these young seedlings as well as the seed which may have matured on the chopped bushes. If the patches you mention are composed of small, thinly distributed plants it is better not to attempt firing.

REGULATIONS FOR IMPORTATION OF GRASS-SEED FROM AUSTRALIA.

THE regulations under the Stock Act, relating to the importation of grass-seed from Australia, made on 21st December, 1925, have been revoked, and the following regulations made in lieu thereof :—

1. For the purpose of these regulations—The term "grass-seed" includes lucerne-seed, clover-seed, and millet-seed: "Statutory declaration" means a declaration made in accordance with the provisions of the Imperial Act now known by the short title of "The Statutory Declarations Act, 1835," or of any Act passed in substitution for or replacing that Act, or containing similar provisions to that Act, and for the time being in force in the State in which such declaration is made.

2. The introduction of grass-seed grown in the State of Queensland or the tick-infestation quarantine-area of New South Wales is prohibited.

3. Grass-seed grown in the State of New South Wales, elsewhere than in the tick-infestation quarantine-area, may be imported into New Zealand subject to the following conditions: (a) That prior to shipment to the Dominion it has been subjected to fumigation by carbon bisulphide, at a strength of 10 lb. to 1,000 cubic feet of chamber-space, for a period of not less than twenty-four hours; and (b) that it is accompanied by a statutory declaration made by the consignor, in the form or to the effect of the First Schedule, and also by a certificate appended thereto, signed by an officer of the Department of Agriculture of that State, in the form of the Second Schedule.

4. Grass-seed grown in the States of Victoria, South Australia, Western Australia, and Tasmania may be imported into New Zealand subject to the following condition: That it is accompanied by a statutory declaration made by the consignor, in the form or to the effect of the Third Schedule.

5. No person shall introduce or import, or attempt to introduce or import, grass-seed into New Zealand in contravention of these regulations.

The regulations came into force on date of publication in the *Gazette* of 19th May. The Schedules comprising the various forms may be seen therein.

FORTHCOMING WINTER SHOWS.

Rotorua A. and P. Association: Rotorua, 21st to 23rd June.
 Taumarunui Winter Show Association: Taumarunui, 15th and 16th July.
 South Taranaki Winter Show Company: Hawera, 29th June to 6th July.
 Wellington Winter Show Association: Wellington, 15th to 30th July.
 Auckland Winter Exhibition: Auckland, 21st to 30th July.

Secretaries are invited to supply dates of their shows for publication in this list.



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No. 1.

DRY-ROT OF SWEDES AND TURNIPS.

SEED SHOWN TO BE PRIME CARRIER OF THE DISEASE.

G. H. CUNNINGHAM, Mycologist, Biological Laboratory, Wellington.

[The following abridged article has been prepared for the Journal by Dr. Cunningham from a technical bulletin treating fully his investigation and conclusions on this disease, which has just been issued by the Department of Agriculture under the title "Dry-rot of Swedes and Turnips: Its Cause and Control."—Ed.]

DRY-ROT is to-day the most serious disease attacking swedes in New Zealand, for in a season favourable to its spread it may destroy from 50 to 100 per cent. of the crop. On turnips its effects are generally much less severe, but even with this host the loss may amount up to 40 per cent. Infected bulbs become a total loss; consequently the direct loss from this disease is much greater than is first apparent, for loss of the greater part of the swede crop seriously affects the carrying-capacity of the farm.

Appearance and Effect on the Hosts.

The appearance of the disease varies considerably according to the part of the plant attacked; therefore this will be considered in relation to each part.

Leaves: Small circular spots, slightly sunken below the surface, tobacco-brown or ashy-grey in colour, appear on leaves, first becoming noticeable on the cotyledons, and present thereafter until maturation of the bulb. In these spots small black bodies, the fruiting structures of the causal organism (termed pycnidia), soon make their appearance. These bodies are frequently arranged in concentric circles.

Bulbs: Early infection of the bulb occurs in the region of the neck, and on account of frequently being hidden beneath the leaves the lesions are often overlooked. The lesions produced are at first small and leaf-green in colour; they soon become slightly sunken, and turn grey or brown. In small bulbs the disease soon spreads through the tissues, causing death of the bulb. At this stage the lesions are few, but often of considerable size. Later they become more numerous and are often scattered over the whole surface of the bulb, though rarely below ground-level. They do not penetrate so deeply into the flesh; consequently, though more numerous, they seldom kill the plant outright until later in the season, when the lesions tend to merge one with

another. Such a condition is followed by death of the bulb ; it does not tend to rot, however, as do those infected earlier in the season, but dries out and assumes a " mummied " appearance. The appearance of the disease is frequently masked by the presence of another pathogen, which sets up a soft rot.

Pycnidia are often abundant in lesions on bulbs, but are by no means characteristic, as they are just as frequently absent.

Stems : On stems of cabbages and flowering-spikes of swedes and turnips are produced lesions brown or grey in colour. On cabbages infection is frequently followed by death of the plant, but on spikes small depressed areas only are produced, the spike rarely being killed unless the lesions are very numerous.

Siliquas : On the siliquas (seed-pods) characteristic brown or ashy-grey lesions are found. In the interior of the pod a flocculent mycelium is often present, extending to and surrounding seeds in the vicinity of the lesions. The significance of this seed-infection will be made clear later in this article.

Life-history of the Causal Organism.

Dry-rot is caused by the fungus *Phoma lingam*. In New Zealand it has hitherto commonly been attributed to *Phoma Napobrassicae*, but in his technical bulletin the writer has shown this to be a synonym of the former. *Phoma lingam* has been found in the Dominion on swede and turnip bulbs, leaves, spikes, siliquas, and seed ; and on leaves and stems of cabbage, but not on kohlrabi, chou moellier, rape, or wild turnip, nor other weeds belonging to the family Brassicæ.

Experiments conducted in this Laboratory have proved that the disease is perpetuated by means of resting mycelium in the seed-coat. When the seed germinates this structure (termed the testa) is frequently carried upwards on the tips of the cotyledons. Before the latter expand the fungus grows out from the testa into the cotyledon tips, there producing a small lesion (brown in colour, and therefore readily noticeable) on one or both cotyledons. This lesion is formed by the hyphæ of the fungus penetrating into and destroying the cells of the leaf. These turn brown die, and among them knots of hyphæ are produced which eventually take the form of flask-shaped receptacles or pycnidia.

In the pycnidia very many one-celled colourless spores are produced. The pycnidium, as has been shown, is embedded in the tissues of the leaf, and opens to the exterior by means of a small apical pore (termed an ostiolum). The spores are embedded within the pycnidium in a mucilaginous matrix, which is strongly hygroscopic—that is, it has a strong attraction for water. Consequently in wet or humid weather the mucilage absorbs water to such an extent that it swells and is forced through the apical pore of the pycnidium as a small gelatinous tendril, carrying with it the embedded spores. In this manner spore-discharge occurs, but as such is possible only in the presence of abundant moisture it will be seen that discharge is possible only during wet or humid weather, and cannot occur during dry weather. The tendril is soluble in excess water ; consequently in wet weather it becomes of a liquid nature, and is washed down the leaf or spattered in rain-drops



FIG. 1. DRY-ROT FUNGUS (INDICATED BY ARROWS) GROWING FROM SLEDs TO CULTURE MEDIA THREE DAYS AFTER PLATING. $\times 5$

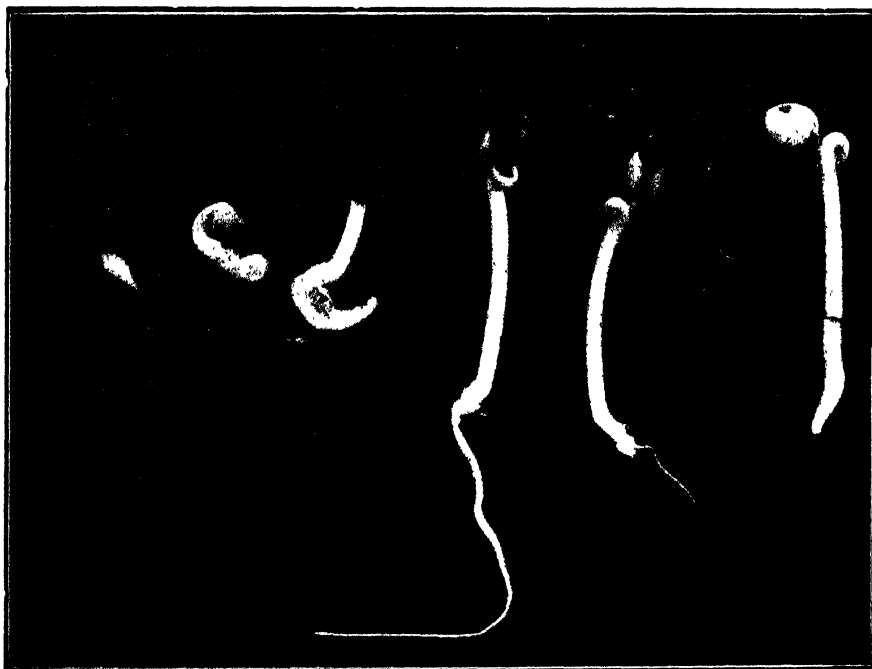


FIG. 2. GERMINATING SWEDE-SEEDLINGS, SHOWING MANNER IN WHICH TESTAS (SEED-COATS) ARE CARRIED UPWARDS ON THE COTYLEDON TIPS $\times 2$.

Arrow points to dry-rot lesion on cotyledon of plant on the right.

[Photos by H. Drake,

to leaves of contiguous plants, each drop carrying very numerous spores. If a dry spell prevails, the spore tendril dries out and becomes firmly fixed to the surface of the leaf (or bulb, as the case may be); consequently, until moisture is again present, spore-dispersion is not possible. Spores may remain alive in dried mucilage for over six weeks, but if the mucilage is removed they live for only five to ten days or less.

It will thus be seen that the disease is carried to the field in the seed, and therefore that diseased seedlings will be present in the field a

fortnight or less after sowing, their number varying according to the proportion of disease present in the seed. This proportion varies greatly, in some lines being about one infected seed in a thousand, in others as high as five seeds per hundred. If dry conditions are met with after sowing, or if the seed is sown late in the season (say, January), the probability is that these initial infection sources are considerably lessened, and possibly in extreme cases eliminated.

The fungus spreads by means of the spores to other leaves of the same plant, and to other plants in the vicinity. Apart from forming lesions on the leaves it does little damage, however, for as yet no bulbs are formed. Further, it has been found that at this stage the disease seldom spreads beyond the initially infected plant, or beyond those in its immediate vicinity.

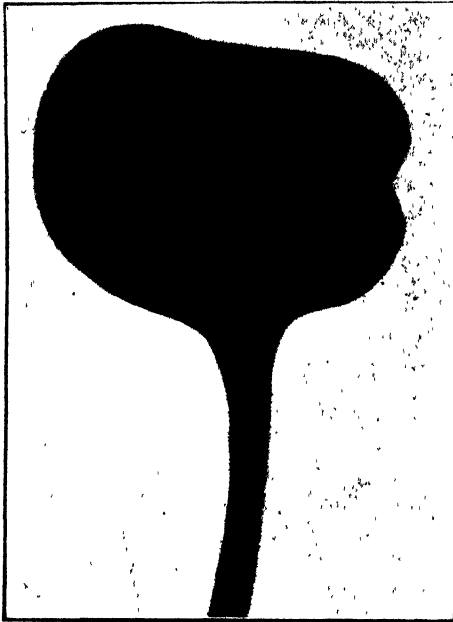


FIG. 3. SEEDLING LEAF OF SWEDE TWELVE DAYS AFTER GERMINATION, SHOWING LESION PRODUCED BY THE DRY-ROT ORGANISM. > 5.

[Photo by H. Drake.

Such a condition prevails until from six to eight weeks after sowing—until, in fact, the bulb has begun to develop. At this stage dry-rot lesions become noticeable owing to death of occasional plants in the field, these showing rapid wilt and discoloration of the leaves. The crowns of such plants are completely rotted, although the bulbs may be quite healthy. Infection of these individual plants occurs from spores being washed from the leaves by way of the channels on the upper surfaces of the leaf-stalks to the crown. In the lesion thus produced numerous pycnidia are formed, and from these, during moist weather, spore tendrils are produced. These bulbs serve as the chief means whereby the disease carries over the earlier parts of the season, for the fungus can live in the bulb-tissues for several weeks, and, whenever the weather conditions are moist, during the whole of this period is capable of producing spores. These, as has been shown, are

embedded in mucilage. Now, as leaf-motion in the field is constant, leaves frequently brush these tendrils and in turn become infected; or the tendrils may thus be carried on to other surfaces and spores washed to the crowns of contiguous plants by rain. The significance of this primary bulb-infection is that infection centres, capable of infecting over a considerable period, are established over the field.

From these centres the disease spreads to contiguous plants in the rows, so that within a few weeks after scattered infected plants have

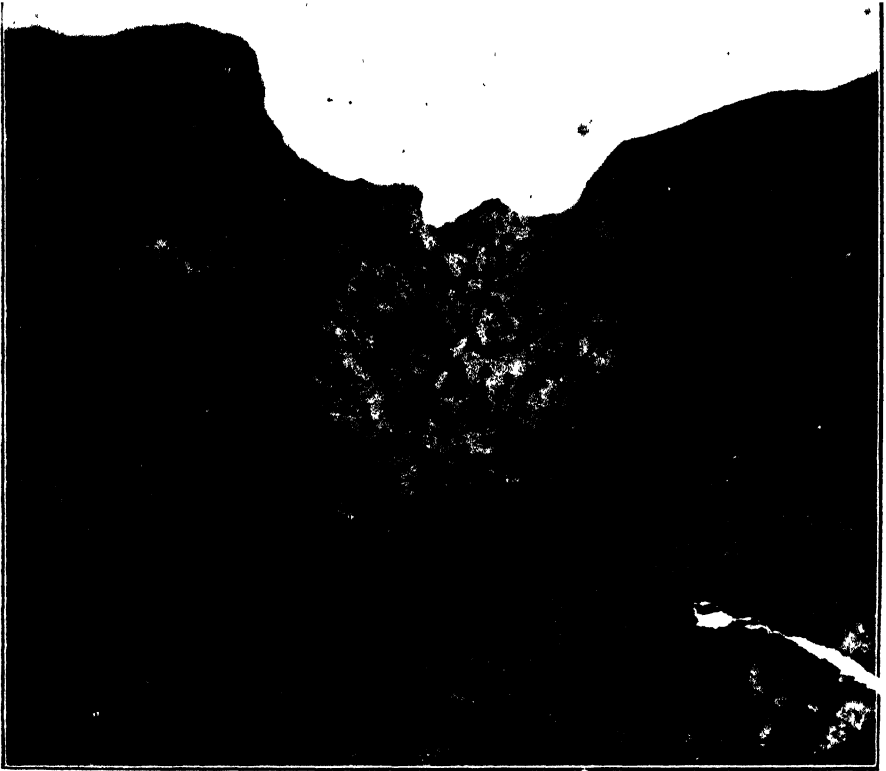


FIG. 4. LESION PRODUCED BY THE DRY-ROT ORGANISM IN SWEDE-LEAF. X 10.

The black bodies are the pycnidia.

[Photo by H. Drake.]

become noticeable others in their vicinity show lesions, and in turn rot. It must be stressed that infection in the field is possible only where spores are brought into contact with the leaf or bulb. Such contact is effected by means of the leaves or by the spores (embedded in mucilage) being splashed to other plants in rain-drops. That is why infected plants at this or a later stage occur in the nature of small irregularly circular areas, and not simultaneously over the field. Wind plays only an indirect part in spore-dispersion—that is, by

moving the leaves about, or in blowing drops of rain containing spores to contiguous plants. It follows, therefore, that if one field is separated from another by a road or similar gap, the disease cannot be transmitted across such a gap, provided insects, animals, or cultural implements do not carry the disease from diseased to healthy plants across the intervening space. And as moisture is essential to spore-production, this explains why the disease is more severe in wet seasons or in wet or low-lying areas in the field; for under such conditions spore-production is continuous and infection can occur almost continuously. Conversely, dry-weather conditions inhibit infection; so that in certain localities of New Zealand, and in certain seasons throughout, little or no dry-rot is present.

From the small initial infection areas the disease gradually spreads outwards, so that frequently these infected areas merge and their individuality is lost. Should wet-weather conditions prevail, the disease may in the course of two or three months spread throughout the whole field; in fact, in the South it is not unusual to find in a season favourable to dry-rot 80 per cent., or even more, of the crop affected.

Initial bulb-infection is invariably followed by death of the plant. This is due to the fact that the diameter of the bulb is small and the lesion quickly destroys all tissues in its vicinity. Later, as the bulbs become considerably larger, the number of lesions present may be large, but each may penetrate to a slight extent only, so that the bulb, although with numerous lesions, may not decay for several months. Complete decay of large bulbs, as a rule, occurs only towards the end of the season, when they may dry out and assume a mummied appearance. Such mummied bulbs are a possible source of infection the following season, for unless they are buried they may lie on the ground (even when ploughed, as the cultural implements frequently bring them to the surface) until the next crop has appeared. This applies generally only when a crop has been fed off late (as in September) and a second crop of the same host sown early (as in November). The writer has shown in his bulletin that the disease may persist in these mummied bulbs for several months, but cannot persist in the soil in any other form.

Leaf-infection occurs of necessity first in the life-cycle of dry-rot. Later, when the bulbs are formed, bulb-infection is the more common; but at all stages leaf lesions may be found. Lesions develop chiefly on the neck and crown of the bulb, less commonly on the side (save where much exposed), and very seldom at or below ground-level. The explanation of this is that most of the spores are distributed by leaf-contact first with diseased plants, then to the healthy leaves or bulbs. The rarity of ground-level infection shows that seldom are the spores carried to this part, and this can be explained when the shape of the average bulb is considered. As has been shown, spores are washed down from the leaves to the crown and neck of the bulb, or deposited on the neck and crown directly by leaf-contact. If a bulb is normally upright the shoulder prevents the spores being washed to the lower portion; if, on the other hand, the bulb is inclined, the shoulder is no longer a protection, and heavy infection may result. Infections at or below ground-level are, of course, merely accidental.



FIG. 5. NECK-INFECTION OF SWEDE-BULB. NATURAL SIZE.

Note the complete destruction of all tissues in this region.

[Photo by H. Drake.]

on account of their rarity; they occur merely through spores being deposited on the bulb at this point, those below ground-level occurring only when the soil has been forced away from the bulb, such as happens occasionally when the bulb has been moved by wind or by animals.

It has been shown that the disease is carried in the seed. It is now necessary to explain the manner in which the seed becomes

infected ; and this has been facilitated by the liberal manner in which Mr. C. W. Body, of Kelso, Otago, has allowed us to make use of material from his swede-seed area.

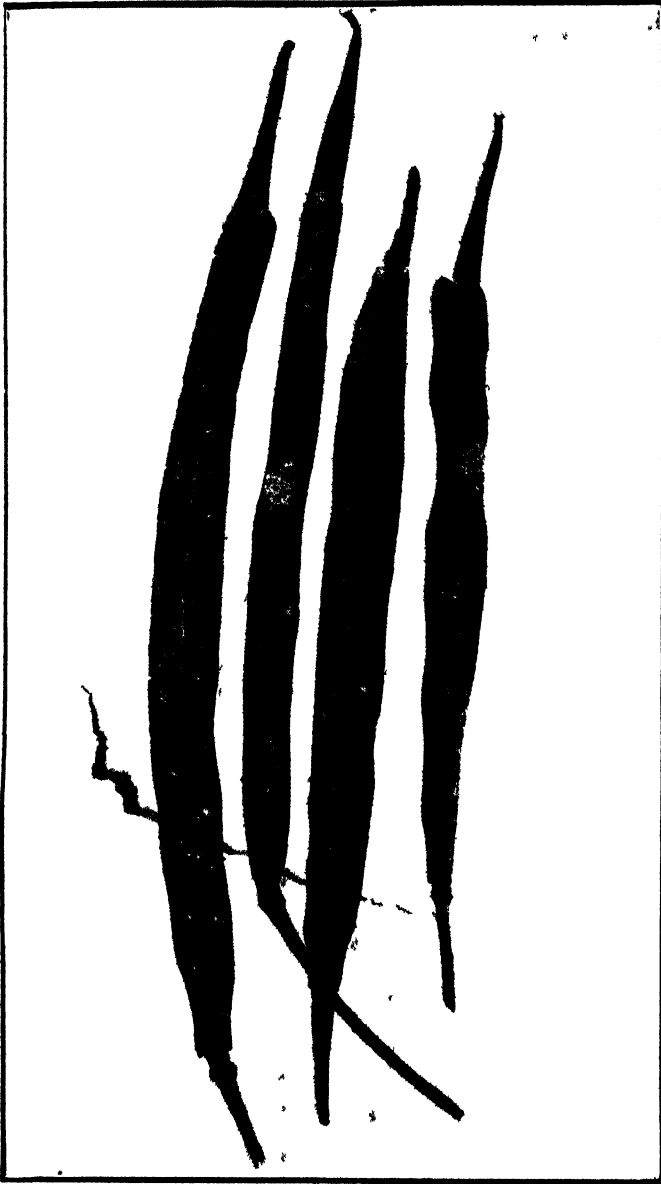


FIG. 6. DRY-ROT INFECTION ON SWEDE SEED-PODS NATURAL SIZE

Seed removed from beneath these lesions produced typical dry-rot colonies on culture media.

[Photo by H. Drake.]

The disease becomes established in bulbs to be used for seed in the usual manner. When the seed-spike develops, its leaves become infected, and the disease spreads from these to the spike. On both are produced abundant lesions, from which spores are produced. As the seed-pods develop, spores are carried to these, the fungus penetrates

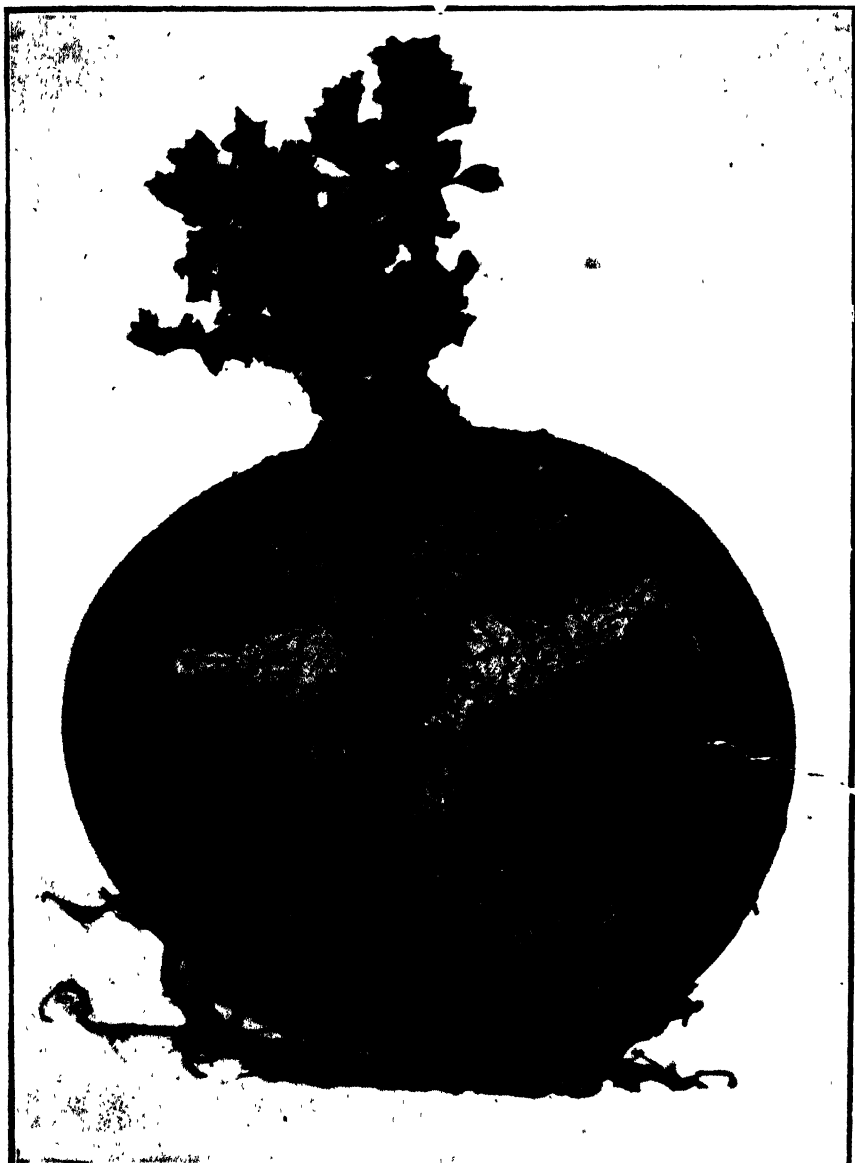
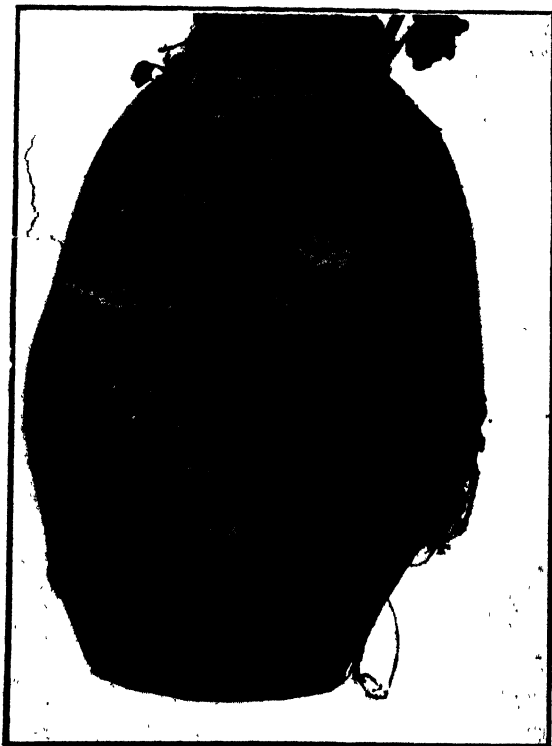


FIG. 7. LESION PRODUCED IN SWEDE-BULB AS A RESULT OF EARLY INFECTION
HALF NATURAL SIZE.

(Photo by F. B. Levy.)

the pod and establishes an infection centre. From this the hyphæ of the fungus grow into the pod, and partially surround the seeds contained therein. The hyphæ grow directly into the seed-coat, and remain there in a quiescent condition until the seed has germinated, when, as has been shown, the fungus grows out from the seed-coat into the cotyledons, there producing lesions from which initial infections of the crop arise. The fungus may remain in a dormant condition in the seed for a considerable period—two or three seasons—but not indefinitely, for it has been established in this Laboratory that it tends to disappear from the seed after long keeping. For example, last season a line of 1926 seed harvested in 1925, containing 5 per cent. of diseased seed, was used extensively in experimental work. This season part of the same line was again used, and was found to contain only 0.1 per cent. diseased seed. This fact—that the disease cannot live indefinitely in the host—is already known with several other seed-carried diseases. It cannot be made use of in commercial control, however, as to keep a line sufficiently long for the disease to disappear would prove expensive, in that the germination percentage of the seed drops considerably each season. For example, the line with 5 per cent. of diseased seed last season gave a germination average of 85 per cent.; this season the germination had fallen to 54 per cent. It is not considered necessary to give here the process elaborated for detecting the presence of the disease in a line of seed; this has been dealt with fully in the bulletin.



[FIG. 8.]

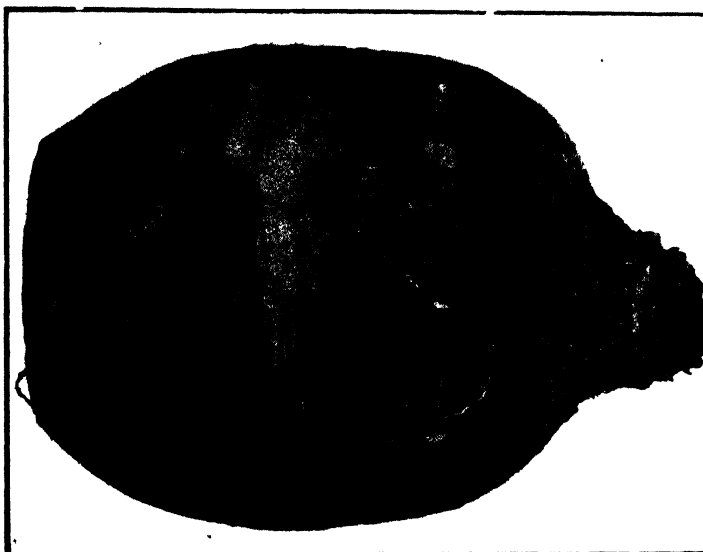


FIG. 9.



FIG. 10.

FIGS. 8, 9, 10. DIFFERENT TYPES OF LESIONS PRODUCED
ON SWEDE-BULBS. HALF NATURAL SIZE.

[Photos by H. Drake.

Methods of Control of Dry-rot.

As dry-rot is seed-borne, it naturally follows that some method of treating the seed so as to destroy the fungus without affecting seed-germination would be the efficient method of combating it. Therefore a comprehensive series of experiments was conducted with the object of finding some such treatment. In these experiments it was found that the standard treatments for externally borne diseases were quite ineffective; and also that the standard methods for internal seed-borne diseases were equally ineffective. Finally, the following original method was found completely to eliminate the disease without material damage to the seed, *always provided this was initially of high-germination capacity*.—

Treatment: Half fill small cloth bags holding 2 lb. of seed or less; immerse these for one hour in a 0.25-per-cent. solution of Semesan held at 115° F. Ensure that seed is properly covered with the solution during this period. Remove bags, drain off surplus water, and spread seed in thin layers to dry (preferably on blotting-paper in a sunny place), or dry by passing through the seed (spread out in thin layers on cheese-cloth) a current of air heated to about 80° F.

In addition to using disease-free seed, or seed which has been treated so as to destroy the fungus, it is necessary that such be sown on land which has not been under swedes, turnips, or cabbages for twelve months. For, as has been shown, mummied bulbs may carry the disease for sufficiently long a period to cause infection of the following season's crop.

In numerous field experiments conducted during the past season it was found that the treated seed used did not suffer appreciably as a result of the treatment specified above, and in many of the crops the treatment appeared to have a decidedly stimulating effect. Further, the treatment proved quite satisfactory as a controllant of the disease where extraneous sources of infection were eliminated.

Unfortunately, it is not practicable under present conditions to treat the swede and turnip seed coming into New Zealand so as to free it from disease, for it has been found that, unless the initial germination of the seed is high, serious depreciation in germination follows treatment. Consequently, with the great bulk of seed coming into the Dominion, treatment would seriously affect germination, as the germination of the average line is not of the first order. Another factor operating against bulk treatment is the present method of handling seed. A number of lines are forwarded in sealed 1 lb. or 2 lb. bags. To open these, treat the seed, rebag, and reseal would entail an enormous amount of work, necessitating the employment of a considerable staff. And to treat the bulk seed would require the erection of a large plant and the employment of highly skilled specialists.

These factors, together with others of a technical nature—which need not be enumerated here—make it appear more reasonable to employ some other method of elimination of the disease from the seed. Two other and more practicable methods are open to consideration.

One of these is to eliminate the disease from the seed before it comes to this country ; the other, to grow in New Zealand disease-free seed.

To eliminate the disease from the seed before it comes to New Zealand seems to be, for the time at least, the more reasonable method, as then use could be made of the available machinery for distribution, and competition with the British seedsmen avoided. If swede- and turnip-seed growing were practised in the Dominion (and there is nothing to prevent its being a success under proper management) competition with seedsmen and merchants would be inevitable—a condition which could be met only by legislation.

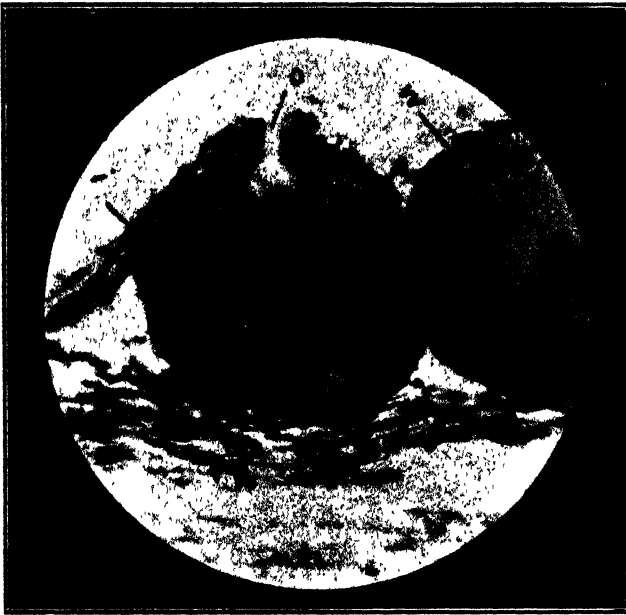


FIG. 11. SECTION OF PYCNIDIUM OF THE CAUSAL ORGANISM.
X 125.

(Photo by Writer)

In Britain (which supplies all but a few hundredweight of our annual requirements) most of the bulk seed is grown by farmers under contract to the seedsmen. The latter supply pedigree seed, raised for the most part on their own farms from selected bulbs, to the growers, who in turn sow it either directly in the fields, or else first sow in seed-beds or boxes and transplant the seedlings when they have reached a stage when the bulb is about the thickness of a lead-pencil. Sowing or transplanting is carried out in early autumn (August), and the crop harvested about twelve months later. The seed-spikes are cut and handled just as are oats or wheat, and, when dry, are stacked in long ricks until ready for threshing. A good average yield of turnip-seed is about 1,800 lb. per acre. Now, as we imported 564,480 lb. of swede and turnip seed in 1926, a rough calculation will show that to produce this amount, with an average

yield of 1,500 lb. per acre, 375 lb. of seed (here termed "mother seed") would require to be sown. To treat this amount would prove a relatively simple matter; and, what is of greater moment, even were germination reduced by 50 per cent., the loss incurred would be slight compared with the same loss were the bulk seed treated. One other point of interest is worthy of mention here. The seed coming to New Zealand is at least one year old before it reaches the farmer; consequently, unless of the finest quality, its germination will have been reduced by keeping by from 5 to 15 per cent. Such seed, if treated, may suffer considerable reduction in germination here because of this initial reduction, but would suffer little damage if treated twelve months previously.

Thus, if the seedsmen in Britain were to treat their "mother seed" before it was issued to the contract growers, and if they were in addition to ensure that such was grown on land which had not been under brassicas for twelve months previously, a clean crop would result; for, as has been shown, infection can occur only from contiguous diseased plants, the spores of the fungus not being wind-borne. A clean crop would result in the seed being free from the disease, would result in increased seed-yields, and would eliminate the necessity for our taking any further steps in New Zealand (apart from ordinary farm-management) to deal with dry-rot.

Were such practices adopted in Britain, in a season or two dry-rot might be entirely eliminated from the swede and turnip crops of New Zealand. It appears (to the writer at least) reasonable that this method of fighting dry-rot should be given a fair trial, as then the British seedsmen, who have worked so long to produce the fine strains of swedes and turnips of to-day, would, if they adopted the methods outlined, suffer no appreciable loss, but would benefit in material increase in yields, and particularly in retaining the New Zealand trade. If, on the other hand, growing the seed in New Zealand were resorted to, and clean seed produced, it would be necessary to protect such a developing industry, and prevent the introduction into the Dominion of diseased seed by legislating against the importation of any lines carrying the disease. It would not be possible to enforce such legislation until the machinery for growing and distributing such seed were in operation—a matter requiring several years at least—otherwise we should be faced with a seed famine, for, judging by the samples of 1926 seed tested, few lines would gain admittance were such measures enforced.

Finally, it should be noted by the farmer that on being supplied with clean seed it would be necessary for him to undertake certain simple precautions. These are—

(1) To abstain from sowing swedes or turnips on land which was in a similar crop the previous season.

(2) To clear absolutely all previous season's seed from his drills, &c.

(3) To destroy *any* previous season's swede or turnip seed on his property.

(4) To refuse (when disease-free seed is procurable) to buy from any merchant seed which has not been certified as being disease-free by the Department of Agriculture.

THE OFFICIAL HERD-TEST.

AN ADJUNCT OF THE C.O.R. SYSTEM.

W. M. SINGLETON,* Director of the Dairy Division.

THE Dairy Division is arranging to bring into operation during the coming season a scheme which, though based on methods which have long been in existence in New Zealand, is new in its intended mode of application to the testing of registered purebred dairy cows.

In order that we might know the feeling of breeders on the subject a general outline of the scheme has been circularized among all persons who at present have cows on C.O.R. Test, at the same time criticism being invited. We have been gratified at the prompt and sympathetic response. An overwhelming majority of the replies were enthusiastically in favour of the proposal. The scheme is to be an auxiliary of the Certificate-of-Record testing, and is to go hand-in-hand with it. At the same time the two "tests" are to be kept entirely independent, both in their carrying-out and in their publication or advertisement, and it is desired to assure all persons interested that the C.O.R. test as it stands at present will continue unaltered and uninterfered with. In order to avoid any possibility of confusion it is proposed to designate the new system—the Official Herd-Test, or, abbreviated, the O.H.T. This title, in its absolute distinctness from Certificate of Record, or C.O.R., and the several misnomers in more or less popular usage, such as S.O.R. (semi-official record) and S.O.T (semi-official test), should avoid a merging of the two in the mind of any one considering yield-performances under both methods

MAIN FEATURES OF THE SCHEME

The Official Herd-Test will be open to all breeders entering cows for Certificate-of-Record Test. The rules governing the O.H.T. have, however, not yet been drawn up in detail. The season will be commenced with a brief set of rules covering only the principal items, in expectation that the first year's work will provide experience and more complete knowledge of what is required. In the meantime the following particulars will provide information concerning the more salient features of the system.

(1) The Dairy Division of the Department of Agriculture will accept for Official Herd-Test cows that are registered in the New Zealand herd-book of the breed to which they belong. Several C.O.R. breeders have recommended that the scheme be extended to include grade and even crossbred cows. Our present feeling, however, is that generally this branch of testing is sufficiently well catered for by the association herd-testing and its variants. Nevertheless, where the C.O.R. testing breeder so desires, the Dairy Division will be prepared to extend the Official Herd-Test to include cows other than purebreds in his herd.

(2) No person will be eligible to enter cows for the Official Herd-Test unless he already has at least one cow accepted for Certificate-of-Record Test, and for which he has paid the necessary fee:

Provided that in the event of a person entering cows for this test, and only one cow for C.O.R. Test, he will not be entitled to a refund of C.O.R. fees on withdrawal of the C.O.R. test cow if he desires the Official Herd-Test continued.

(3) The last cow entered for Official Herd-Test must calve not more than ninety days after the date of calving of the last cow entered for C.O.R. Test.

(4) No animal will be eligible for acceptance unless she shall have calved not more than forty-five days prior to the Testing Officer's visit for the purpose of taking samples for C.O.R. Test.

(5) The owner must forward to the Director of the Dairy Division, at least a fortnight before due calving-date, and on a form to be supplied by the Department, an application properly filled in with the particulars required by such form. [NOTE.—The object of requesting a fortnight's notice is to enable us to make arrangements for our Testing Officer to provide the necessary sample-bottles and general outfit required. It is quite recognized, however, that in many instances a fortnight's notice will not be possible for the approaching season, and consequently the rule will not be strictly enforced for this, the first, season.]

(6) Fees will be payable to the Director of the Dairy Division within fourteen days after the taking of the second samples by the Testing Officer.

(7) Milking-machines may be used.

(8) The owner will be expected to arrange his milking-hours to suit the convenience of the Testing Officer.

(9) The owner will be asked to provide whatever means of identification the Director of the Dairy Division may consider necessary. This will probably be by photographs or tattooing in the case of broken-coloured animals, and tattooing for animals of solid colour

(10) Should any cow on Official Herd-Test be sold during the testing-period to a person who has a cow on C.O.R. Test, the Division will endeavour to complete the test. In no other case, however, does the Division guarantee to complete the testing of cows sold before the expiry of their testing-period.

(11) The testing-period will be for a maximum of 305 days, commencing with the day of calving.

(12) The Testing Officer is to have the right at any time to visit the farm on which a cow is under test. He will make his testing visits, as nearly as possible, once every calendar month. For the first milking during his visit he will record the time at which the milking was made, and as opportunity offers he will strip the cows sufficiently to ensure that they have been milked dry. For the remaining milkings of the twenty-four-hour visit he will take check weights and samples, and the last milking is to be twenty-four hours later than the first milking of his visit. All samples are to be kept under lock and key or sealed until tested. No cow will be tested when the yield is less than 4 lb. milk per day. No cow will be tested until a period of at least ninety-six hours has elapsed between calving and the taking of the first sample.

(13) The percentage of butterfat for the month will be that found from the one day's samples taken by the Testing Officer.

Should the average percentage of fat found in the milk during any monthly test be considered abnormal by the Director of the Dairy Division, he may reject that test and use the average percentage of fat obtained from the preceding and succeeding months as a basis for computation of the fat-production for that month. The milk-production for the month will be calculated by totalling the one day's milk-weights taken by the Testing Officer and multiplying the result by the number of days in the month. The monthly fat-production of a cow will be calculated by figuring the total milk credit for the month at the test for the day obtained by the Testing Officer. The season's production will be calculated by totalling the production of pounds of milk and butterfat for each month or part thereof during one lactation period, and not exceeding 305 days, commencing with the day of calving. For the period between calving and the commencement of the calendar month during which the first samples are taken, the yield will be calculated at the rate of the milk weights and test found by the Testing Officer at the time of his first monthly visit after calving. For the period between the three hundred and fifth day, or the drying-off date, and taking of the last samples preceding such date the production will be calculated at the rate of the last milk weights and test found by the Testing Officer. The period between drying-off date and the taking of the last samples is not to exceed forty-five days.

(14) The dates of the Testing Officer's monthly visits to a breeder's farm will be governed by the requirements of C.O.R. testing, and not by cows on Official Herd-Test.

(15) The Director of the Dairy Division may decline acceptance of application in any case where such testing cannot conveniently be undertaken by the existing staff of Testing Officers.

(16) The fee for Official Herd-Testing will be 2s. 6d. per monthly test per cow for each of the first two tests, and in the event of continuance of the test no further fee will be charged for the remainder of the lactation season not exceeding 305 days.

(17) Cows on Official Herd-Test are to be milked either before or after the C.O.R. cows.

(18) The owner will be supplied each month with a statement of the yield of each cow for the preceding month and from date of calving to the end of that month. He will also be supplied at the end of the season with a statement indicating the yield of each cow for that period.

(19) A breeder owning a cow with an Official Herd-Test record must, whenever advertising or publishing the record, use the description "Official Herd-Test," or the abbreviation O.H.T. It will not be permissible to use any description which is likely to be confused with the Certificate-of-Record testing, such as S.O.R. (semi-official record), S.O.T. (semi-official test), &c.

There will, of course, be no minimum butterfat requirement, and no restriction of period between calvings, as in the C.O.R. system. The O.H.T. is merely to provide information relative to yield.

Although provision has been made for a 305-day maximum season there is nothing to prevent the withdrawal of a cow at any prior date the owner may desire.

OBJECTS IN VIEW.

In introducing the Official Herd-Test we have in view several objects of importance to dairy-farmers. The more outstanding of these may be briefly summarized thus : The C.O.R. test entails fairly heavy expense on the breeder, not only on account of the high testing fee, but because of the extra feeding. Purebred herds, just as any other herds, though perhaps to a lesser degree, include cows which should be culled. At low cost a breeder, by means of the Official Herd-Test, will be able to ascertain what cows are worth the care and expense of a C.O.R. test. The Official Herd-Test requires no taking of milk-weights and no preparing of returns of any kind by the owner. The system has been proved adequately accurate for the purpose.

The Official Herd-Test is expected to assist in still wider education of dairy-farmers in the value of butterfat records. Wider education must ultimately mean greater efficiency. Last, and most important, if the Official Herd-Test meets with strong and continued support it must sooner or later assist in increasing the country's average butterfat-production per cow, which is only another way of saying that it must improve the economic position of the dairy-farmer and the dairy industry.

In conclusion, it should be clearly understood that the Official Herd-Test is designed as a means of assisting breeders of dairy cattle in improving the productive capacity of their herds. Any criticism breeders may wish to make will be welcomed.

EXCESS COST OF CREAM TRANSPORT.

DEALING with the question of uneconomic collection of cream in certain districts induced by competition among dairy companies at the recent annual conference of the National Dairy Association Mr W M Singleton, Director of the Dairy Division, remarked as follows

"In a number of districts it is very important that something should be done, by way of co operation, towards reducing the costs of cream delivery. In some districts the block system could be brought in but it may be impracticable for dairy companies in a number of other districts to consider each company confining its operations to an area to be agreed upon. In such instances the question might be considered as to whether one lorry might not take all the cream on its route and deliver it to the respective factories to which it belongs. Where the factories are situated close together this would appear to be practicable.

"We have had a rough survey made of the general position, and it is estimated that excess cost of transport of cream must amount approximately to £35,000. It would appear almost incredible that any dairy company would undertake the cartage of some suppliers' cream under the circumstances reported to me. Lorries from various companies traverse the same road in some districts, and pass from one to three or more dairy factories. Contrast this with the position in another district from which three different companies get supplies of cream by rail. One contractor here carries all the cream to the station, thus facilitating more frequent delivery. My information is to the effect that the position is satisfactory to each of the companies concerned.

"It is high time that more co-operation was evidenced in this matter of cream cartage. Suppliers should get in touch with the directors of their company if they have reason to believe that it is one which is losing money in this manner. Such pressure would probably induce companies to find ways and means of solving the problem. Suppliers should realize that these excess costs are paid out of proceeds from butter-sales, and that if they did not occur the dairy farmer could reasonably expect a higher payment for butterfat."

THE COMPOSITION OF BRAN AND POLLARD.

MEANS FOR DISTINGUISHING QUALITY.

L. D. FOSTER, M.Sc., A.I.C., Chemistry Section, Wellington.

IN the *Journal of the Board of Agriculture* (England) for March, 1917, Wood and Adie described briefly the practices current in England up to that date in the separation of the different parts of the wheat berry in milling. They state that usually flour includes all the particles into which the wheat has been ground which are fine enough to pass through "silks" or sieves with 130 meshes to the linear inch. Those portions of the ground wheat which will not pass through this sieve form the offals; the coarser offals are separated as bran, which does not pass through a wire sieve (No. 16) with sixteen meshes to the linear inch. They give the average results of analyses of a series of samples as follows:—

Table I.

	Moisture.	Protein.	Fibre.	Ash.	Oil.	Carbohydrates.
	%	%	%	%	%	%
Bran	13.63	13.45	10.58	5.40	3.92	53.12
Straight-run offal (= pollard in New Zealand)	13.17	15.52	4.95	3.45	4.41	58.50

The same writers consider that wheat offals are characterized not only by a limited range in the size of their particles, but by a definite chemical composition. In some countries the offals, apart from the bran and pollard, are further subdivided into middlings, fine middlings, sharps, &c. In New Zealand offals are divided only into bran and pollard.

Amos ("Processes of Flour Manufacture," 1920) says that Nos. 11, 12, and 13 silks are usually employed for the dressing of flour.

In the experimental milling operations carried out by the Chemistry Section of the New Zealand Department of Agriculture the wheats are milled on an Allis-Chalmers reduction machine. The bran fractions are obtained on wire sieve No. 16 (sixteen meshes per linear inch), and the pollard fractions on silk No. 12 (120 meshes per linear inch). Methods adopted in the actual milling are varied slightly to give the best results with each individual wheat-sample, but it may be said that for all practical purposes the methods are standardized. It is interesting to note that though the experimental methods were worked out quite independently in order to give the best results on this particular experimental mill, they are almost exactly similar to the commercial methods quoted by Wood and Adie, and Amos, and, indeed, to commercial methods in general. The offals obtained from the local wheat-samples should therefore be similar to and representative of genuine local brans and pollards; and while it is not suggested that the examination of the products of an experimental mill does away with the necessity for further work on commercial samples, the results obtained should be a useful basis for any further work which may be performed in the future. To this end analyses were made of a number

of genuine brans and pollards separated on the Department's experimental mill, and obtained from wheats grown in the Dominion. The following table gives the results of milling of the different samples:—

Table 2.—Milling Results.

Sample No.	Variety.	Locality where grown.	Bran.	Pollard.	Flour.
			%	%	%
S 709 ..	Tuscan ..	Arrowtown ..	15.1	12.2	72.7
S 775 ..	Yeoman ..	Ashburton ..	10.8	15.0	74.2
S 771 ..	Velvet ..	" ..	11.5	14.2	74.3
S 769 ..	Marquis ..	" ..	14.0	16.0	70.0
T 75 ..	College Hunter's ..	" ..	14.8	11.8	73.4
S 773 ..	Velvet Ngapara ..	" ..	10.9	12.9	76.2
S 777 ..	Red Fife ..	" ..	14.6	13.4	72.0
S 712 ..	Tuscan ..	Gibbston ..	12.2	14.1	73.7
T 101 ..	Hybrid W. ..	Horrelville ..	11.0	11.7	77.3
T 52 ..	Solid-straw Tuscan ..	Gore ..	16.2	14.5	69.3
T 77 ..	" ..	Ashburton ..	12.0	16.3	71.7
S 713 ..	Hunter's ..	Tarras ..	15.7	12.0	72.3
Average	..	..	13.2	13.7	73.1

The samples consisted of a number of well-known varieties, and were obtained from widely separated localities.

In the next table are given the results of the analyses of brans, together with the yield of flour and the amount of protein in the flour.

Table 3.—Analyses of Brans.

Sample No.	Flour.		Bran.					
	Yield.	Protein.	Moisture.	Protein.	Fibre.	Ash.	Oil.	Carbo-hydrates.
	%	%	%	%	%	%	%	%
S 709 ..	72.7	11.81	12.44	16.25	10.60	5.53	3.00	55.18
S 775 ..	74.2	14.19	11.08	15.69	10.98	6.12	3.28	52.85
S 771 ..	74.3	13.56	12.47	15.06	10.95	5.48	3.38	52.66
S 769 ..	70.0	13.75	12.09	14.88	10.22	5.04	4.30	53.47
T 75 ..	73.4	10.31	12.40	14.50	9.67	4.20	3.45	55.78
S 773 ..	76.2	11.88	11.78	14.25	11.63	5.19	4.65	53.82
S 777 ..	72.0	10.56	11.40	13.56	10.38	5.03	4.07	55.56
S 712 ..	73.7	9.38	11.93	12.75	11.35	5.86	3.67	54.44
T 101 ..	77.3	9.63	12.76	12.00	10.18	5.40	3.17	56.49
T 52 ..	69.3	9.44	12.10	11.75	10.38	4.27	4.20	57.30
T 77 ..	71.7	9.69	12.65	11.56	11.00	3.37	3.35	58.07
S 713 ..	72.3	7.69	12.46	10.41	10.83	4.56	3.90	58.14
Average of N.Z. samples	73.1	10.99	12.11	13.55	10.68	5.00	3.70	58.31
Average of English samples (Wood and Adie)	..	..	13.63	13.45	10.58	5.40	3.92	53.12

The table is arranged in order of protein content of the brans. The averages for the local samples are practically the same as those obtained by Wood and Adie from their series of English samples, the results of which are given at the bottom of the table.

The results of analyses of the pollards are as follows:—

Table 4.—Analyses of Pollards.

Sample No.				Moisture.	Protein.	Fibre.	Ash.	Oil.	Carbo- hydrates.
				%	%	%	%	%	%
S 709	..	..	..	12·48	17·25	4·70	3·49	3·87	62·08
S 775	..	..	..	11·77	18·13	5·48	4·12	4·08	56·42
S 771	..	..	..	12·17	16·25	4·40	3·36	4·33	59·49
S 769	..	..	..	11·89	15·75	3·42	2·83	3·90	62·21
T 75	..	..	..	12·57	15·13	3·97	2·57	4·27	61·49
S 773	..	..	..	11·69	16·44	5·52	3·95	4·65	57·75
S 777	..	..	..	11·49	15·94	3·58	2·95	4·00	62·04
S 712	..	..	..	11·87	15·13	5·92	4·14	4·87	58·07
T 101	..	..	..	12·68	13·63	4·60	3·50	3·89	61·70
T 52	..	..	..	12·28	12·69	5·00	3·19	4·50	62·34
T 77	..	..	..	12·60	13·93	5·43	2·65	4·07	61·32
S 713	..	..	..	12·49	12·19	3·83	2·70	4·38	64·41
Average				12·16	15·21	4·65	3·29	4·23	60·78
Average of English samples (Wood and Adie)				13·75	15·66	4·52	3·30	4·67	58·13
Average of N.Z. com- mercial samples, 1924				11·35	15·12	5·30	3·46	..	..

The samples in this table are arranged in the same order as those in Table 3. Here again the averages from the analyses of pollards obtained on the experimental mill show a close resemblance in composition to those of the commercial samples analysed by Adie and Wood in England; this is especially so in the figures for fibre and ash. The two sets of average figures in the tables show that the pollards thus differ considerably from the brans in protein, ash, and especially fibre, such figures affording a fairly definite means of differentiation between fair average quality pollards and those containing an excessive amount of bran.

In Table 4 are also appended the averages of thirteen genuine local commercial pollards analysed by the writer in 1924. Here the composition of the local samples resembles even more closely that of the pollards obtained on the experimental mill. It seems fair to assume, then, that offals obtained on the experimental mill differ very little, if at all, from genuine commercial samples, and that data from such samples are applicable to pollards obtained on a commercial scale. This is of considerable importance in the control of the quality of brans and pollards, for it is an easy matter in the mill deliberately to grind part of what should remain in the bran portion sufficiently finely for it to pass into the pollard. Since branny (adulterated) pollards are unsuitable for certain types of stock-feeding, especially the feeding of swine and young calves, it is essential that there should be some form of standardization in such an important feeding-stuff. Since the quality and composition of wheat vary somewhat each year, and from what has been said above, it would appear that information obtained from analyses of experimentally milled offals should be a useful guide each year to the quality and genuineness of similar commercial products.

The following table gives the limits in composition of the genuine brans and pollards obtained on the experimental mill:—

Table 5.—Limits in Composition.

—		Protein.	Fibre.	Ash.	Oil.	Carbohydrates.
		%	%	%	%	%
Brans	..	16.25—10.41	11.63—9.67	6.12—4.20	4.65—3.00	58.07—52.66
Pollards	..	18.13—12.19	5.92—3.42	4.14—2.57	4.87—3.87	64.41—56.42

There is thus a fairly well defined difference in the chemical composition of the two products. The differences between the fibre and ash figures are at once apparent, though it should be mentioned here that in the case of one bran (T 77) its ash content was found to be 3.37 per cent. This is such an abnormal figure that it is excluded from the table. Moreover, if such a bran were milled so that part of it passed into the pollard, attention would not be drawn to the presence of bran because its ash content would be so nearly that of genuine pollard.

It must be pointed out, too, that the above results were obtained from individual samples representing distinct and rather widely differing varieties. The miller generally blends several varieties of wheat, and is for that reason more likely to produce offals with compositions closer to the averages, but rarely approaching the outside limits given in Table 5. From an examination of the figures obtained for protein and ash in local samples of offals it should be possible to say whether they have been separated by the methods of usually accepted milling practice—that is, whether the pollards contain an average or an excessive amount of branny particles.

SUMMARY.

(1) Twelve samples of bran and twelve of pollard, obtained from pure local varieties of wheat, and separated on an experimental mill, were analysed.

(2) The results agreed closely with those obtained from a series of English commercial samples of brans and pollards examined by Wood and Adie.

(3) The pollards also resembled closely in composition a series of good average quality commercial pollards milled locally and examined in 1924.

(4) The averages of results showed a distinct difference between bran and pollard in protein, fibre, ash, and carbohydrates. From an examination of the protein, fibre, and ash figures one should gain a fairly good idea of the quality of the products. The differences, it is thought, are distinct enough to afford a means of distinguishing between fair average quality and adulterated pollards.

Stock Improvement.—Records continue to show that ownership of purebred males leads promptly to a large number of purebred female animals in all classes of stock kept and to a gradual grading-up process, with the reduction of scrub stock to a negligible number.—United States Agriculture Year-book, 1925.

LAMB-FATTENING ON FORAGE CROPS.

TRIALS IN MARLBOROUGH, SEASON 1926-27.

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THE lamb-fattening trials at Seddon, which were initiated in 1925-26, were continued in the past season. A full account of the first season's operations was published in the *Journal* for July, 1926. It will be remembered that when production costs were balanced against the net returns from the fat lambs the results on a per-acre basis worked out as follows: Peas, £2 6s. 6d. loss; rape, £4 10s. 3d. profit; chou moellier, £1 18s. 9d. profit; lucerne, £2 3s. 9d. profit.

It may be recalled that the peas at first drafting gave 80 per cent. of fat lambs, but that no second feeding was available. It was also shown in the previous article that even if ordinary field-peas at as low a cost as 6s. per bushel had been used the results would not have been payable, especially in view of the fact that general experience shows that field-peas are not only less palatable but also less efficacious than wrinkle-peas for fattening purposes. In view of these considerations it was decided to discontinue the tests with peas during the past season.

As previously, a total area of 10 acres, fenced into five 2-acre blocks, was used. Water was laid on to each plot, and every precaution taken to secure even and comparable conditions in regard to soil, manuring, and feeding conditions.

The lambs used were again crossbreds—English Leicester ram on half-bred ewes.

Weather conditions in the 1926-27 season differed very materially from those in 1925-26, as the following rainfall records kept at Seddon will show:—

1925-26 Season.			1926-27 Season.		
Month.	Rainfall (Inches).	Number of Wet Days.	Month.	Rainfall (Inches)	Number of Wet Days
September ..	2.31	12	September ..	1.79	12
October ..	1.73	10	October ..	3.28	16
November ..	0.72	5	November ..	2.43	15
December ..	0.25	3	December ..	6.13	10
January ..	1.31	9	January ..	0.17	2
February ..	2.66	8	February ..	1.64	6
March ..	2.73	5	March ..	1.40	6
April ..	0.37	6	April ..	1.11	5
Totals ..	12.08	58	Totals ..	17.95	72

It will readily be seen that the growing season in 1926-27 was much more favourable than that of 1925-26. In the former season extremely dry weather set in in January, and, coming as it did in sharp contrast to the wet weather of the spring, it caused the rank growth of fodder, especially in the case of rape, thousand-headed kale, and chou moellier, to wilt somewhat before the lambs could be turned on. The lucerne, which had grown very rank after the first hay-cut, had to be mown before the lambs could be turned on. The crops

tested this season were 2-acre plots of (1) lucerne, (2) Japanese millet, (3) rape, (4) thousand-headed kale, (5) chou moellier.

All crops were manured with 44-46 per cent. superphosphate at the rate of 2 cwt. per acre, the lucerne, an established stand, being, of course, simply top-dressed. In preparation for sowing the land received the following cultivation: In the autumn (1926) the ground was given two strokes with the cultivator to kill weeds. Ploughing was carried out in August. The ground broke up very finely, so that little further cultivation was necessary. Three strokes of the harrows followed ploughing, then another stroke just before drilling. After drilling, the ground was rolled. The millet plot also received two more strokes of the harrows after sowing, while the lucerne stand was given three strokes with a Hustler cultivator in August.

On 18th January, 1927, 20 lambs were put on the lucerne plot, and 45 per plot on the Japanese millet, rape, thousand-headed kale, and chou moellier. The lambs at time of going on to the plots were evenly assorted, and were worth approximately 18s. per head.

On 11th February, 1927, the first draft of fats was taken off, an even standard of selection being adopted. The results were as follows:—

Lucerne	..	..	..	16 fat out of 20 =	80 per cent.	
Japanese millet	..	..	27	..	45 =	60 ..
Rape	..	..	33	..	45 =	73 ..
Thousand-headed kale	..	26	..	45 =	58	..
Chou moellier (1 missing)	..	44	..	44 =	66	.. (on 45)

After the first drafting, 37 lambs were put back on the lucerne and 30 on the rape. When these two plots were eaten off it was found to be impossible to obtain space at the freezing-works, so that all the lambs had to be moved on to other feed for a time. As near as can be judged from the condition of the lambs when they were taken off the plots there was an even number of fats (18) from each plot, or a total of 36. This makes approximately 50 per cent. fat in the second draft from the lucerne, and 60 per cent. from the rape. The second drafts were taken off on 23rd February, 1927. This draft may be put down as worth 18s. per head when turned on to the rape and the lucerne respectively.

On 14th March it was again found possible to turn lambs on to all the plots, the apportionment being somewhat as follows: Lucerne, 30; Japanese millet, 30; rape, 30; chou moellier, 25; thousand-headed kale, 25. None of the feed lasted long enough to make the lambs prime. An assessment for grazing for twelve days—that is, to 26th March (exclusive)—has therefore been made. The value of the fodder works out at approximately 1s. per head per week.

The experiment of chaffing lucerne hay from the spring cut was tried this season. Owing to the wet spring, however, the quality of the hay was somewhat inferior. Throughout the two seasons in which trials have been in operation the lambs have shown little tendency to consume either lucerne hay or chaff. In both seasons the conditions at the times of feeding off have been extremely dry.

FREEZING-WORKS REPORTS.

The freezing-works reports on the first and second drafts may be summarized as follows:—

FIRST DRAFT TAKEN ON 11TH FEBRUARY.

(1) *Lucerne : 16 Lambs.*

Grade.					Number.	Net Weight. lb.
To 36 lb.	..	..	..	..	11	369
36 lb. to 42 lb.	..	..	..	..	3	114
Second quality	..	..	..	..	2	68
Total	..	..	..	..	16	551

Average weight, 34.44 lb. Price realized, £1 2s. 8d. per head ; total, £18 2s. 8d.

(2) *Japanese Millet : 27 Lambs.*

Grade.					Number.	Net Weight. lb.
To 36 lb.	..	..	..	..	19	629
36 lb. to 42 lb.	..	..	..	..	6	234
Second quality	..	..	..	..	2	68
Total	..	..	..	..	27	931

Average weight, 34.5 lb. Price realized, £1 2s. 9d. per head ; total, £30 14s. 3d.

(3) *Rape : 33 Lambs.*

Grade.					Number.	Net Weight. lb.
To 36 lb.	..	..	..	..	18	608
36 lb. to 42 lb.	..	..	..	..	7	266
42 lb. to 50 lb.	..	..	..	..	1	43
Second quality	..	..	..	..	6	205
Rejects	..	..	..	..	1	35
Total	..	..	..	..	33	1,157

Average weight, 35.06 lb Price realized per head (inclusive of 1 reject), £1 2s. 5d. ; total, £36 19s. 9d.

(4) *Thousand-headed Kale : 26 Lambs.*

Grade.					Number.	Net Weight. lb.
To 36 lb.	..	..	..	..	15	500
36 lb. to 42 lb.	..	..	..	..	7	271
Second quality	..	..	..	..	4	127
Total	..	..	..	..	26	898

Average weight, 34.54 lb. Price realized, £1 2s. 5d. per head , total, £29 2s. 10d

(5) *Chou Moellerher 30 Lambs.*

Grade.					Number	Net Weight. lb.
To 36 lb.	..	..	..	..	21	697
36 lb. to 42 lb.	..	..	..	..	7	266
Second quality	..	..	..	..	2	66
Total	..	..	..	..	30	1,029

Average weight, 34.3 lb. Price realized, £1 2s. 7d. per head ; total, £33 17s. 6d.

SECOND DRAFT, TAKEN ON 23RD FEBRUARY.

Joint Report on Fats.

Grade.					Number.	Net Weight. lb.
To 36 lb.	..	..	..	..	7	229
36 lb. to 42 lb.	..	..	..	..	5	187
Second quality	..	..	..	..	22	711
Rejects	..	..	..	..	2	48
Total treated	..	..	..	..	36	1,175

Average weight, 32.6 lb. Average price per head (inclusive of rejects at lower price), 19s. 11d. delivered at the works. Total price realized, £35 17s., divided equally between 18 lambs off rape and 18 lambs off lucerne £17 18s. 6d. each.

No third draft of fats was taken, but, as already mentioned, it was possible on 14th March to turn 140 lambs on to the plots, the apportionment being—lucerne, 30; Japanese millet, 30; rape, 30; thousand-headed kale, 25; chou moellier, 25. None of the feed lasted long enough to fatten. The fairest estimate that can be made is to allow 1s. per head per week for grazing. Taking into consideration the time taken to fatten the lambs—twenty-six days—out of which time they were twelve days on the plots and fourteen days subsequently feeding elsewhere, this price works out approximately correctly. The lambs were worth about 16s. when they went on to the plots, and in four weeks, according to the price received, were worth on an average about £1 per head. Fodder-values were reckoned as follows: (1) Lucerne for twelve days for 30 lambs at 1s. per head per week, £2 11s. 6d.; (2) Japanese millet for twelve days for 30 lambs, £2 11s. 6d.; (3) rape for twelve days for 30 lambs, £2 11s. 6d.; (4) thousand-headed kale for twelve days for 25 lambs, £2 2s. 10d.; (5) chou moellier for twelve days for 25 lambs, £2 2s. 10d.

RETURNS FROM VARIOUS CROPS.

Lucerne.

Gross returns: First draft, £18 2s. 8d.; second draft, £17 18s. 6d.; third feeding, £2 11s. 6d.; 1½ tons lucerne hay left uneaten, at £3 per ton, £4 10s.: total, £43 2s. 8d.

Expenses: Cost of production—labour, seed, manure, cultivation, haymaking, and top-dressing, £1 16s. per acre; annual rental value, about £1 7s. 6d. per acre. It must be reckoned, however, that the first cut or feeding of lucerne in September would at least pay the rent. Then, again, no allowance has been made for those lambs in the first draft which were grazed without being fattened. Taking these facts into consideration, full production cost is allowed at £1 16s. per acre, or £3 12s. for 2 acres. Sixteen lambs fattened in first draft were worth 18s. per head when put on to the plot, a total of £14 8s.; 18 lambs in second draft were worth 18s. per head, total £16 4s.

Adding these items we have a total debit of £34 4s., and this amount deducted from the gross returns of £43 2s. 8d. leaves a net profit of £8 18s. 8d. for 2 acres, or £4 9s. 4d. per acre.

Japanese Millet.

Gross returns: First draft, £30 14s. 3d.; second draft, nil; grazing for third lot of lambs, £2 11s. 6d.: total, £33 5s. 9d.

Expenses: Cost of production—cultivation, seed, manure, &c., £5. Rent of land: It may be safely assumed that grazing for the lambs which did not actually finish on the mullet paid for the rent. Value of first draft (27), 18s. per head when they went on to plots, or £24 6s.

Total debits thus amount to £29 6s., which deducted from the gross returns of £33 5s. 9d. leaves a net profit of £3 19s. 9d. on 2 acres, or £1 19s. 10d. per acre.

Rape.

Gross returns: First draft, £36 19s. 9d.; second draft, £17 18s. 6d.; grazing for third lot of lambs, £2 11s. 6d.: total, £57 9s. 9d.

Expenses: Rent defrayed by balance of lambs grazed but not finished on rape in first draft. Production cost—cultivation, seed, manure, &c., £4 16s. 6d. Value of first draft (33) at 18s. per head when put on to plots, £29 14s.; second draft (18) at 18s., £16 4s.

The total debits of £50 14s. 6d. being deducted from the gross receipts of £57 9s. 9d., a net profit of £6 15s. 3d. is shown on 2 acres, or £3 7s. 7d. per acre.

Thousand-headed Kale.

Gross returns: First draft, £29 2s. 10d.; grazing from third lot, 1s. per head, £2 2s. 10d.: total, £31 5s. 8d.

Expenses: Rent paid for by lambs grazed but not finished in first draft. Production cost—cultivation, seed, manure, &c., £5 8s.; value of first draft of lambs at 18s. per head, £23 8s.: total, £28 16s.

Deducting this amount from gross returns, a profit is shown of £2 9s. 8d., or £1 4s. 10d. per acre.

Chou Moellier.

Gross returns: First draft, £33 17s. 6d.; grazing from third lot at 1s. per head, £2 2s. 10d.: total, £36 0s. 4d.

Expenses: Rent defrayed by lambs grazed but not finished in first draft. Production cost—cultivation, seed, manure, &c., £5 14s.; value of first draft at 18s. per head, £27: total, £32 14s.

Net profit, £3 6s. 4d. from 2 acres, or £1 13s. 2d. per acre.

Summary.

The profit per acre for each of the five crops may be summarized as follows: Lucerne, £4 9s. 4d.; Japanese millet, £1 19s. 10d.; rape, £3 7s. 7d.; thousand-headed kale, £1 4s. 10d.; chou moellier, £1 13s. 2d.

Last season every crop showed a profit with the exception of peas. This season every crop tried has shown a profit. As was the case last season, the highest margins of profit are from lucerne and from rape. This season lucerne is easily first, the margin of profit being more than double that of last season. The margin of profit from rape is lower this season than it was last season. Japanese millet has shown a net profit of just under £2 per acre, against a failure last season. Chou moellier has shown within a few shillings of the margin of profit recorded last season. Thousand-headed kale, tried for the first time on the plots at Seddon, in spite of the fact that it had the advantage of being grown after peas, although quite profitable, yet shows a smaller margin than any of the other crops.

The thanks of the Department of Agriculture and of the Awatere branch of the Farmers' Union are due to Mr. C. P. Gainsford for his co-operation in carrying out the work on the plots (again located on his farm), and to Mr. N. West, stock agent of the N.Z. Farmers' Co-operative Association, for drafting of lambs; also to the New Zealand Refrigerating Company, which donated the manure for use on the plots.

STINKING-SMUT OF WHEAT.

V. SUMMARY OF THREE YEARS' EXPERIMENTS ON CONTROL, AND DETAILED RESULTS FOR 1926-27 SEASON.

J. C. NEILL, Field Mycologist, Biological Laboratory, Wellington.

Three Years' Summary.

THE combined results of the past three years' field experiments with the best known seed treatments for the control of stinking-smut in wheat are here presented (Table 1). Each year the treatments have been carried out on the main wheats of New Zealand—Solid-straw Tuscan, Hunter's, and Pearl or Velvet Chaff—the samples of which were obtained from ordinary machine threshed and dressed commercial lines. Over 100,000 individual wheat-seeds were sown by hand during the experiments, and the resultant plants pulled and the heads counted. The experiments were carried out in the open on normal Canterbury wheat-growing land, at the Ashburton Experimental Farm. The figures given in the table represent the number of grain-bearing heads produced by an equal number of wheat-seeds from the same bulk sample, treated and untreated, growing in adjacent rows under apparently identical conditions. The number of heads produced is not necessarily an accurate measure of comparative yields, but it is the nearest approximation that the experimental conditions would allow. The figures for each year, which include all the wheats used, are given separately in the table so as to show how far the conclusions to be drawn from the combined results may be relied upon to represent the facts in any one of the years.

Table 1.—Combined Results of Three Years' Experiments on the Control of Stinking-smut.

Treatments.	Total Heads produced.		Decrease or Increase due to Treatment.	Total Smutted Heads.	
	Treated.	Untreated.		Treated.	Untreated.
Copper carbonate dust—					
1925	19,505	19,466		25	1,964
1926	7,242	7,350		5	1,104
1927	13,714	15,412		0	1,290
Total for 3 years ..	40,461	42,228	Decrease 4.1%	30	4,358
Semesan dust, 1 oz. per bushel—					
1925	6,179	5,739		0	622
1926	3,435	3,338		2	343
1927	3,206	3,403		11	390
Total for 3 years ..	12,820	12,480	Increase 2.7%	13	1,355
Semesan steep, 1 hour at 0.2%—					
1925	5,966	5,919		0	840
1926	3,441	3,445		11	372
1927	3,157	3,272		0	384
Total for 3 years ..	12,564	12,636	Decrease 0.6%	11	1,596

Table 1—continued.

Treatments.	Total Heads produced.		Decrease or Increase due to Treatment.	Total Smutted Heads.	
	Treated.	Untreated.		Treated.	Untreated.
Uspulun, 1 hour at 0.25%—					
1925	6,136	5,871		0	735
1926	3,565	3,558		6	536
1927	3,220	3,300		0	362
Total for 3 years ..	12,921	12,729	Decrease 1.5%	6	1,633
Germisan, ¼ hour at 0.25%—					
1925	6,135	5,750		0	810
1926	3,534	3,545		4	465
Total for 2 years ..	9,669	9,295	Increase 3.9%	4	1,275
Clarke's Wheat Protector—					
1925	5,091	5,911		4	754
1926	3,123	3,705		0	486
1927	2,560	3,469		0	311
Total for 3 years ..	10,774	13,085	Decrease 17.6%	4	1,551
Bluestone, 1%—					
1925	5,875	6,425		21	671
1926	2,864	3,339		0	473
1927	2,273	3,531		0	324
Total for 3 years ..	11,012	13,795	Decrease 20.1%	21	1,468
Bluestone, 2%—					
1925	5,051	6,289		6	786
1926	2,585	3,834		0	484
Total for 2 years ..	7,636	10,123	Decrease 24.5%	6	1,270
Formalin, 1-320—					
1925	3,432	6,332		2	714
1926	3,192	3,642		0	427
1927	2,967	3,260		0	434
Total for 3 years ..	9,591	13,243	Decrease 27.5%	2	1,575
Formalin, 1-480—					
1925	4,274	6,180		8	814
1926	3,126	3,534		0	402
1927	3,154	3,241		0	489
Total for 3 years ..	10,554	12,955	Decrease 18.5%	8	1,705

The general conclusions may be briefly summarized as follows :—

(1) The copper carbonate dust treatment satisfactorily controlled stinking-smut, but produced 4 per cent. fewer heads than the same weight of untreated seed.

(2) Clarke's Wheat Protector, bluestone 1 per cent., and formalin 1-480 all controlled the smut very well, but caused a decrease in production of 17 per cent., 20 per cent., and 18 per cent. respectively. It

should be noted that most of this decrease with formalin occurred in 1925, in which year the seed was allowed to dry out thoroughly after treatment and before sowing.

(3) Bluestone 2 per cent. and formalin 1-320 caused a decrease of 24 per cent. and 27 per cent. respectively

(4) The mercurio-phenol preparations, Semesan, Uspulun, and Germisan, gave good but not complete control of the smut, with, on the whole, a slight improvement in production.

(5) All the treatments eliminated stinking-smut in one or two of the seasons, but none was completely successful in all three.

Experimental Results for 1926-27.

(For details of materials and methods see second article of this series in *Journal* for May, 1925.)

Copper Carbonate.—Five makes of copper carbonate were used in this season's experiments, one of them, Corona, containing approximately 18 per cent. copper, the others from 40 per cent. to 50 per cent. All were dusted on to the smutted seed at the rate of 2 oz. per bushel. No significant difference was shown by any of the brands; all completely eliminated the smuts, with, on the whole, a slight drop in germination and heads produced as compared with the adjacent untreated controls.

Colloidal Copper.—A new preparation by the Pittsburgh Plate Glass Co., Newark, N.Y., U.S.A. It gave very similar results to copper carbonate, except that disinfection was not quite so complete.

Semesan.—Used both as a dust at 1 oz. per bushel and as a 0.2-per-cent. solution in which the seed was steeped for one hour at room-temperature. As a dust it failed to completely eliminate the smut in either of the three wheat varieties, smut appearing, curiously enough, in the treated rows of Velvet Chaff, while the untreated rows remained quite clean. As a steep Semesan gave complete disinfection. No significant difference was shown by either of the Semesan treatments in germination or heads produced as compared with the untreated controls.

Uspulun.—Seed steeped for one hour in 0.25 per cent. solution at room-temperature. Gave complete control of the smut, with a slight improvement in germination over controls.

Clarke's Wheat Protector.—Gave complete control of the smut, but caused a considerable drop in germination.

Bluestone (Copper Sulphate).—Seed dipped for ten minutes in 1 per cent. solution at room-temperature, kept covered and moist overnight, and sown on the following day. This treatment completely controlled the smut, but lowered the number of plants by 44 per cent. and the number of heads by 35 per cent. as compared with controls.

Formalin.—Seed steeped at room-temperature for ten minutes in solutions made up at the rate of 1 part commercial formalin (39 per cent.) to 320 parts water (1 pint in 40 gallons), and 1 part formalin to 480 parts water (1 pint in 60 gallons). The steeped seed was covered and kept moist overnight, and sown on the following day. Both treatments completely controlled the smut. The 1-320 steep lowered germination and heads by about 10 per cent., and the 1-480 steep by 1 per cent. to 2 per cent.

Table 2.—*Stinking-smut Experiments at Ashburton Experimental Farm, Season 1926-27.*

Dates of sowing: Controls of Velvet Chaff, 19/5/26 all remainder, 28-31/5/26. First count, 8-10/8/26; final count, 3-6/2/27.

Treatment.	Velvet Chaff.						Solid-straw Tuscan.						College Hunter's.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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Control ..	93.5	85.5	1.30	82.0	164	0 00	516	0 00	96.5

Hot Water.—Seed presoaked for six hours at 55° F., then dipped for ten minutes in water held at temperatures ranging from 125° to 131° F. There was a progressive decrease in smut with increase in temperature of dip, but even at 131° complete control was not attained. The treatments progressively depressed germination and heads, until at 131° both were about 40 per cent. below controls. It appears that the hot-water method does not efficiently control stinking-smut.

All the samples of wheat used were kindly supplied by the Canterbury (N.Z.) Seed Co., Ltd., from the 1926 harvest.

Notes on Infection of Wheat with Stinking-smut.

A striking feature of the series of experiments detailed above is the apparently unaccountable variation in the percentage of plants showing smutted heads when grown from seed dusted with equal amounts of smut spores. During the whole course of the experiments a standard dosage was used of 1 part of smut spores to 750 parts by weight of wheat. The spores were prepared by macerating unbroken smut-balls of the previous season, sifting out the shells, &c., and vigorously agitating with the wheat for five minutes in a closed glass flask. The whole bulk sample of each wheat to be used in the experiments was thus dusted and thoroughly mixed before any was withdrawn for treatment or sowing. Both smut-balls and wheat had been kept thoroughly dry in the Laboratory.

In 1924-25 the smut inoculum used had been collected from various crops in Southland, and was found on microscopical examination to consist entirely of spores of *Tilletia Triticum* Wint.* This produced the following percentages of smutted plants in the controls: Pearl, 1.9; Purple-straw Tuscan, 9.8; College Hunter's, 8.1; and Solid-straw Tuscan, 46.4. The same year a series of plots of 200 seeds of Purple-straw Tuscan were sown at weekly intervals from 17th May to 20th September. These showed a wide range of infection, the percentage curve rising steeply from 1.5 per cent. in the 17th May sowing to 35 per cent. in that of 9th June. Thence, with some violent fluctuations, the curve gradually fell to 14 per cent. in the sowing of 23rd August, and then very steeply to zero in the last sowing on 20th September. (*Journal*, May, 1925, p. 312.)

In the next season's experiments (1925-26) the smut inoculum used was collected from the control rows of the previous year's Solid-straw Tuscan. It was again exclusively composed of *Tilletia Triticum* spores. Mean percentages of smutted plants in the controls were: Velvet Chaff, 19.4; College Hunter's, 21.0; Solid-straw Tuscan, 4.1. The two former were sown on 10th June and the Solid-straw Tuscan on 19th August.

For the following season (1926-27) smut-balls were collected separately from each of the wheat varieties used in 1925-26. In each sifted sample used for inoculum about 0.01 per cent. of spores of *Tilletia levis* Kuehn. were present, the rest being spores of *Tilletia Triticum*. The main sowings of Velvet Chaff were dusted with spores from Solid-straw Tuscan, College Hunter's with spores from Velvet Chaff, and Solid-straw Tuscan with spores collected from College Hunter's. Mean percentages of smutted plants in the controls were: Velvet Chaff, 0.0;

* Species identifications by G. H. Cunningham, Mycologist.

College Hunter's, 17.2; Solid-straw Tuscan, 15.2. A feature of the results with Velvet Chaff is that, while only one smutted plant appeared in the whole series of controls, 0.6 per cent. appeared in the rows treated with Semesan dust, and 2.6 per cent., 1.8 per cent., and 0.4 per cent. in the hot-water treatments at 125°, 127°, and 129° F. respectively. The control rows of Velvet Chaff were all sown on 19th May, but heavy rain prevented further sowing till 28th May, when the Velvet Chaff treatments were sown, followed during the next two days by the rest of the sowings. Among these latter were sown a series of plots (400 seeds each) of each of the three wheat varieties dusted with spores from the three collections at 1 to 750 parts by weight. The results, given in the following table, appear only further to confuse the issue.

Table 3.—Infection Experiments with Stinking-smut.

Method of Inoculation	Plants.			Heads.		
	Total.	Smutted.	Percentage smutted.	Total.	Smutted.	Percentage smutted.
Solid-straw Tuscan × spores from Solid-straw Tuscan	324	86	26.7	1,192	340	28.5
Solid-straw Tuscan × spores from Velvet Chaff	327	96	29.3	1,179	371	31.4
Solid-straw Tuscan × spores from Hunter's	326	48	14.7	1,168	176	15.0
Velvet Chaff × spores from Velvet Chaff	325	18	5.5	1,030	63	6.1
Velvet Chaff × spores from Solid-straw Tuscan	322	2	0.6	972	2	0.2
Velvet Chaff × spores from Hunter's ..	325	131	40.3	1,057	410	38.8
Hunter's × spores from Hunter's ..	306	21	6.8	910	64	7.0
Hunter's × spores from Solid-straw Tuscan	319	116	36.3	1,000	381	38.1
Hunter's × spores from Velvet Chaff ..	324	55	16.9	980	190	19.3

Aroma in Tobacco.—"Australian tobacco interests are concerned about tobacco-aroma," reports Mr. T. H. Patterson, Fields Division. "American leaf is the standard for the world. Is aroma due to soil or climate, or do both combine to produce aroma? These are the questions awaiting answers. Sufficient soil was brought from North Carolina, where it is considered the best leaf is grown, to lay down two plots—one fertilized, the other not. Side by side are two plots of Australian soil taken from Bathurst Experimental Farm, where the trials are being conducted, one being fertilized and the other not. The soil is set on concrete, with concrete divisions, to prevent seepage from the soil outside from plot to plot. The cost of bringing the soil was about £200. The Australian leaf aroma is different from that of American, and the smoker looks for the latter, as he is accustomed to it."

Soil Survey in United States.—The total area surveyed in detail to date is 684,451 square miles, and is about equal to the combined areas of Norway, Sweden, France, and Germany. No other country in the world has amassed any such store of knowledge concerning its soil resources. — *United States Agriculture Year-book, 1925.*

FARMERS' RAILWAY EXCURSIONS IN THE SOUTH ISLAND.

Fields Division.

THE institution of interprovincial excursions for farmers in the South Island this year has met with distinct success. Organized by the Railway Department and assisted by the Department of Agriculture, the excursions so far arranged have received excellent support from the farming community, and expressions of satisfaction as to the itineraries followed clearly demonstrate that interprovincial visits are highly popular and profitable.

The first excursion train ran from Clinton to Christchurch on 10th May. Over three hundred farmers, mostly accompanied by their wives, constituted the party. The excursion, which lasted for four days, was intended to show Otago farmers something of the conditions existing in Canterbury, and to this end an itinerary was prepared embracing a visit to Lincoln Agricultural College, the Addington sale-yards, the Belfast freezing-works, and other places of interest to farmers. Canterbury people extended the greatest hospitality to the visitors.

A return of amenities was effected when an equally large body of Canterbury farmers visited Dunedin for four days on 31st May, spending most of their time at the Winter Show and on trips to the Taieri Plain.

Another excursion to Canterbury was arranged for Southland farmers on 17th May, when a large number visited Canterbury, closely following the itinerary followed by the Otago farmers.

A feature which proved of undoubted interest and utility to those travelling by the various trains was the exhibit of an instructional nature which accompanied each excursion. These exhibits were prepared by the Fields Division in Dunedin and Christchurch respectively, and were installed in a second-class carriage, one side of which was fitted with a long show-bench upon which were ranged the articles, charts, &c. These were designed to demonstrate various interesting and instructive phases of farming, and formed a basis for discussion *en route*. The carriage was placed in the centre of the train for ease of access, and during the run officers of the Fields, Live-stock, and Dairy Divisions were kept extremely busy discussing different pertinent matters with the travelling farmers. Competitions were also arranged, farmers being asked to identify twelve specimens of seeds and grasses common to their farms, and so on. (Photos of the demonstration car are reproduced on the two following pages.)

The value of such interprovincial visits is undoubtedly very great from many points of view. The weather on all the trips was most favourable, and contributed greatly to the success of the excursions.

After the above notes were written an excursion of Westland farmers to the Ashburton district of Canterbury took place at the end of June, and a return visit to Westland has been arranged for the present month, the demonstration car and discussions again figuring in the programmes.

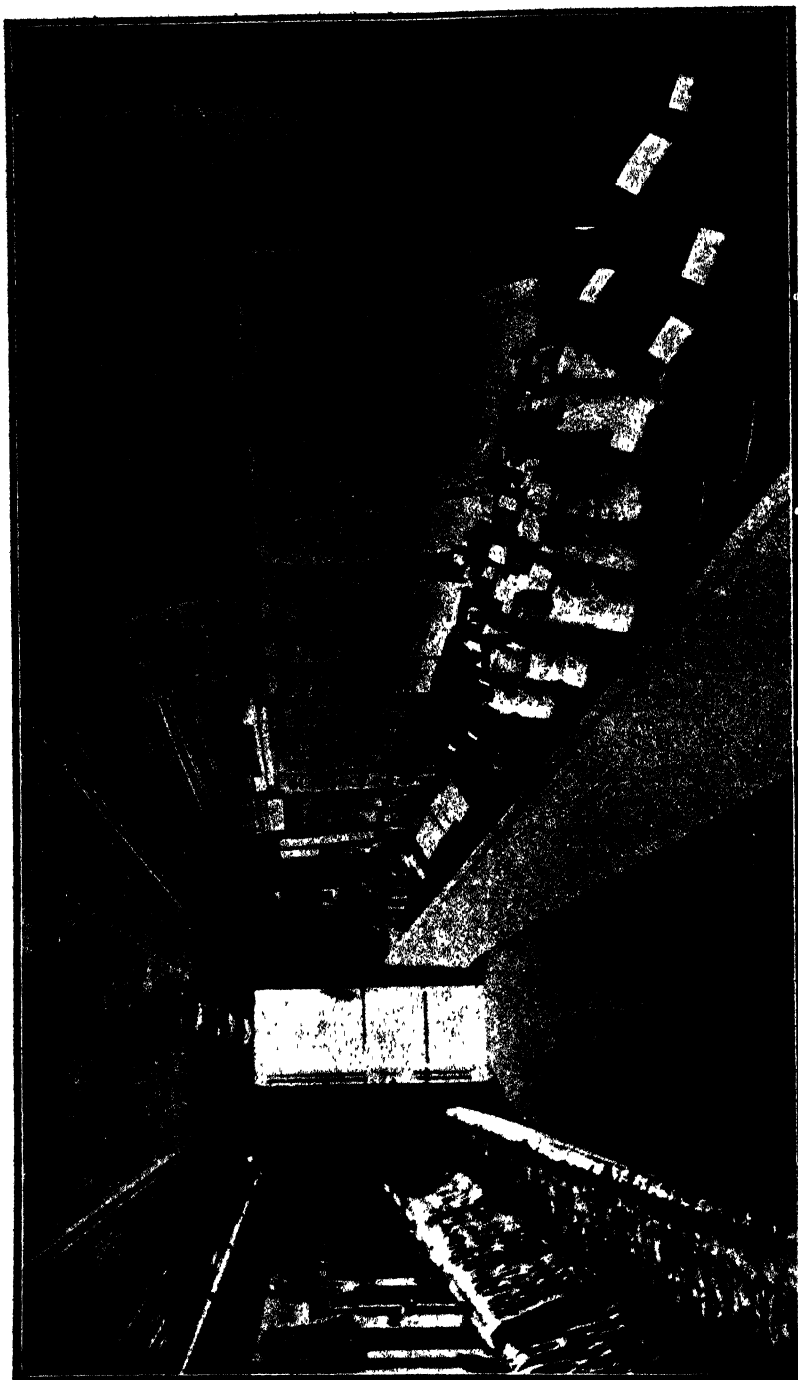


FIG. 1. INTERIOR OF DEMONSTRATION CAR ON THE OTAGO FARMERS' EXCURSION TRAIN, ARRANGED BY THE FIELDS DIVISION, DUNEDIN.

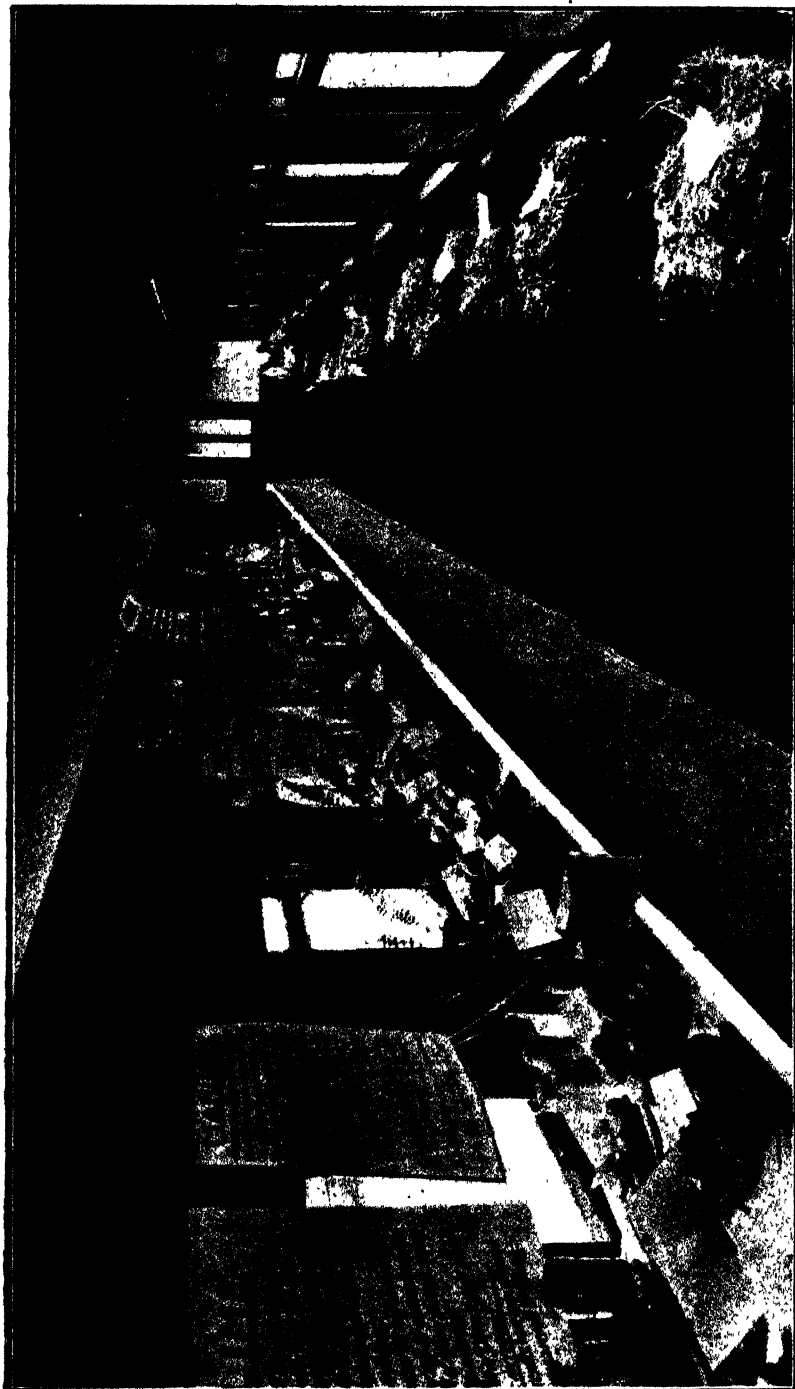


FIG 2. THE CAR REARRANGED FOR THE CANTERBURY--OTAGO EXCURSION BY THE CHRISTCHURCH STAFF OF THE FIELDS DIVISION.

MANURING OF CITRUS-TREES.

P. EVERETT, Orchard Instructor, Thames.

THE four essential constituents of the soil necessary to the productive-ness and general fertility of the citrus orchard are lime, nitrogen, phosphoric acid, and potash. These constituents need to be applied in different forms, different quantities, different proportions of each, and at different times of the year to suit individual orchards. Therefore in dealing with the subject of manuring one can only give a general outline of the principles, from which each citrus-grower should be able to draw up a manurial programme that will be most suitable for his particular grove.

Never has there been any thorough and systematic experiment conducted in this country to fully prove the relative value of the various manures at present in general use in citrus orchards; consequently any recommendations in this direction must be made on the results of experiments conducted in other countries, combined with the practices adopted by successful citrus-growers both in and beyond the Dominion. Any figures supplied or recommendations made in this connection should be taken only as a basis on which to work, each grower taking into consideration the nature of his soil, the manures applied in past years, the health of his trees, and the quality of fruit at present being produced. The successful grower is a lifelong experimenter; each grove should be an experimental station, no matter what the conditions may be. Production of quality and quantity of fruit should be the first consideration, and proper manuring is one of the greatest factors in bringing about these results. Nor should one be satisfied with maintaining the fertility of the soil; in very many cases increasing it is equally as important if success is to be attained.

It is still widely believed that an analysis of the soil is all that is needed to show what manures are necessary to give the desired results. Soil-analysis shows the content of nitrogen in its soluble and insoluble forms, and also the total and "available" mineral plant-foods. The "available" constituents are estimated by their solubility in weak citric-acid solution—an arbitrary method that has proved of great value in determining the fertility of British soils, but the applicability of which to New Zealand conditions has still to be fully demonstrated. Soil-analysis alone cannot serve as a definite index to the manurial programme, although it may provide a useful indication of the lines on which experiments should be conducted in the field.

Every 1,000 lb. of lemons and oranges contains the following :—

		Nitrogen.	Potash.	Phosphoric Acid.
Lemons ..	..	1 ½ lb.	2 ½ lb.	1 lb.
Oranges ..	..	2 lb.	2 ½ lb.	1 lb.

These three constituents combined make what is termed a complete manure, and with the addition of lime no further ingredient need usually be added to give the desired fertility to the soil.

LIME.

Lime has the effect of correcting acidity and mechanically improves the condition of the soil, liberates plant food—especially phosphates

and potash—decomposes organic matter, promotes nitrification and bacterial activity, and generally increases soil-fertility. Although one's soil may be shown to have an abundant supply of lime, it is often profitable to apply more, as lime is often not in that readily available form which is so necessary for the tree.

NITROGEN.

Citrus-trees respond most readily to nitrogen, and this ingredient should never be omitted from the manurial programme except where the trees are already making very vigorous growth and the fruit shows signs of becoming coarse or rough. Nitrogen may be applied in many different forms, but stable or farmyard manure usually gives the best results. However, these natural manures are not always obtainable at a reasonable cost, and when this condition prevails artificial nitrogenous fertilizers have to be resorted to. Dried blood has been found a good fertilizer for citrus-trees, also nitrate of soda and sulphate of ammonia. These three fertilizers are used extensively in citrus groves throughout the world.

GREEN-MANURING.

This practice may also be included in the category of nitrogenous manures. Most soils require humus, and when the natural supply is exhausted it must be replaced if the grove is to be kept in a profitable state. Leguminous plants are most desirable for this purpose on account of their habit of forming nodules on their roots which contain a high percentage of nitrogen. Many different legumes are used, including blue lupins, white lupins, field-peas, golden tares, horse-beans, &c. The blue lupin is probably grown more extensively in New Zealand than any other cover-crop, and has been found to give excellent results on most soils. It is generally advisable to apply a dressing of 2 cwt. or more of superphosphate per acre when sowing lupin-seed; this has been found to greatly stimulate the growth of the cover-crop. In Auckland Province early in April is a suitable time for sowing lupin-seed, and the crop should be ploughed or disked in as soon as the first blossoms show. If lupins are not buried at or before this stage of growth the main stem of the plant soon hardens; consequently decomposition takes considerably longer. Two bushels of seed per acre will give a good cover-crop.

PHOSPHORIC ACID AND POTASH.

In addition to nitrogen, phosphoric acid and potash are required for most soils, and are generally used in citrus groves the world over. Phosphoric acid is best supplied as superphosphate or with organic nitrogen as bonedust; perhaps even better would be a combination of the two. Potash is best supplied as sulphate of potash; muriate of potash is also a good fertilizer.

TIME FOR APPLICATION.

Quickly soluble fertilizers, such as nitrate of soda and sulphate of ammonia, are best applied in three or four equal dressings and at intervals of from five to six weeks. The first application should be made just as the spring growth is commencing. Better results will

be obtained by this practice than when the total amount of these fertilizers is applied at one dressing. With slowly soluble organic nitrogen this need not be practised. Blood-manure is best applied in two dressings, two-thirds being given prior to the spring ploughing or disking, and one-third prior to the autumn ploughing or disking. Phosphatic fertilizers are also best applied in two dressings, but in reverse proportions to those recommended for blood-manure—that is, one-third prior to the spring ploughing or disking and two-thirds previous to the autumn tillage.

A writer in a recent issue of the *Californian Citrograph*, claiming to have had considerable experience in manuring citrus-trees, states that the trees must be well supplied with phosphates in order to secure a heavy bloom of fruit blossoms, and that from experiments it has been proved that a liberal autumn application of superphosphate will ensure this condition. This may or may not be applicable in this country, but, as it is rapidly becoming the general practice in most large citrus groves of Australia, California, and Florida to apply phosphatic fertilizers in the autumn as well as in the spring, we must naturally follow the lead given by these older countries unless later experience teaches us that other practices will give better results.

Potash will probably give best results if applied in the autumn, although if applied in the spring it may be equally as beneficial. It is claimed by certain American writers that if this fertilizer is applied in the autumn, together with phosphates, the effect will be a hardening of the late summer and autumn growth, making the tree more resistant to frost. Whether this is so or not, it is worthy of mention that many of the successful citrus-growers of California are now following this practice of manuring with phosphates and potash in autumn.

QUANTITY OF FERTILIZERS TO APPLY.

The amount of the various fertilizers that it will be profitable for a grower to apply in his grove each year must be largely a matter of conjecture until systematic experiments of this nature have been carried out in this country, and even then the amounts will vary according to quality of soil, quality of fruit being produced, and age and productive capacity of the trees. The tendency of citrus-growers the world over during recent years is to apply a greater quantity of fertilizers each year. What was considered a heavy dressing five years ago is now considered totally inadequate. From personal observations and inquiries in many parts of this country and in Australia, supplemented by reports on manurial experiments conducted in other countries, I am of the opinion that for a lemon or orange grove in full bearing and in a moderately healthy state the following will be a safe basis on which to work out individual manurial programmes, the figures given being for an area of 1 acre :—

			To be applied in Spring.	To be applied in Autumn.
Blood-manure	..	..	3 cwt.	2 cwt.
Bonedust	..	..	2 cwt.	1 cwt.
Sulphate of potash	..	..	..	1½ cwt.
Superphosphate	..	..	2 cwt.	4 cwt.

Plus four applications of nitrate of soda at the rate of 1 cwt. per acre. For trees making poor growth or producing undersized fruit the nitrogenous fertilizers to be increased by at least as much again.

All fertilizers should be spread evenly over the entire ground in groves that have been planted for more than three years, and not confined to a circle round each tree.

FURROW-MANURING.

Another very different system of applying manure to citrus-trees is what is known as "furrow-manuring." This system has probably never been tested in New Zealand, but in other countries many successful growers are reported to have adopted it. The method, briefly described, is to make furrows between the rows of trees about 12 in. to 14 in. deep and approximately the same width, then to fill the bottom 6 in. of the furrow more or less with farmyard manure and fill in the top portion with the soil taken out. There are many different ways in which the furrows can be arranged. Probably the best arrangement for the first year is to make the furrows near the tips of the branches on both sides of each row of trees. The furrows for the second year can be made at right angles to those of the preceding year. In the third year the furrows can be ploughed out in the same direction as those of the first year, but farther away from the trees, so as not to disturb the masses of feeding-roots that will be found in the manure applied two years previously. In the fourth year the furrows can be made near those of the second year. The fifth year's furrows should be made in the same position as those of the first year, and during succeeding years the plan of the first four years can be repeated. It is a well-known fact that sowing fertilizers in a citrus orchard has the effect of bringing the feeding-roots very close to the surface of the soil. It is claimed that furrow-manuring prevents this condition, and keeps the feeding-roots well down in the soil where they will not be affected by the drying-out of the surface soil.

It is also claimed that a furrow-manured citrus grove will produce a greater quantity of fruit and fruiting wood, and better-quality fruit, than when given the same manure not buried deeply. Obviously, the amount of manure to be applied in furrows will be governed by the same conditions as in other systems of manuring. In general, about 10 c. ft. of good dairy manure for each tree in full bearing is considered a good dressing. This furrow application of manure is usually supplemented by lime and nitrogenous fertilizers, so as to bring the total amount of nitrogen application for each large and full-bearing tree up to about 3 lb. per tree. Furrow-manuring can be done at any time of the year, but the most popular time is during the autumn months.

Sowing of Pine-seeds.—During the past season a series of sowings of insignis and Corsican pine seeds was made by the State Forest Service in various districts to ascertain the best period for sowing. The results (reports the Service's *Newsletter*) prove that the practice of sowing in October–November cannot safely be departed from. Seed sown too early in the season was slow to germinate, and a considerable wastage occurred, while that sown later than December had too short a period for development before the winter months, and the small plants, not having a sufficient root-system, were lifted out by frosts.

Importation of Cattle.—An application for a permit to import cattle from the United States of America was considered by the Board of Agriculture at its last meeting. The Board decided to recommend that it be declined.

BIOLOGICAL CONTROL OF ST. JOHN'S WORT.

R. J. TILLYARD, M.A., Sc.D., F.R.S., &c, Chief of Biological Department,
Cawthron Institute.

[*St. John's wort* was referred to briefly in Dr. Tillyard's main report on the biological control of noxious weeds, published in the *Journal* for February last. The present article is the substance of a special report made to the Australian Commonwealth Government.—Ed.]

THE problem of the control of this weed is one of special interest to Australia, but may be said to concern New Zealand also, though more for the future than for the present. The St. John's wort (*Hypericum perforatum*), as seen everywhere in Europe, is an annual herb, with a maximum height of about 2 ft., but seldom more than 18 in. The stem is stiff and erect, the leaves green with a slight bluish-green tinge, and covered with tiny transparent dots indicating the presence of oil-glands. The flowers are bright yellow, five-petalled, star-like, borne in large terminal clusters. The plant grows rather late in the season in Europe, young plants not beginning to show up to any extent until June; August and September are the main flowering months, while the seed ripens in October.

This plant is freely grown in gardens, and was probably brought into Australia originally for that purpose. It was introduced into Victoria more than fifty years ago. After a period of acclimatization to its new surroundings it began to spread with amazing rapidity, and at the present time it occupies about 150,000 acres in that State, while smaller but rapidly growing areas of the weed are to be found in South Australia and New South Wales. In New Zealand it was apparently a later arrival and has taken longer to become acclimatized; nevertheless, there are not wanting at the present day disquieting signs that it is beginning to spread in a number of localities, and it is clear that the sooner it is dealt with the better will be the prospects of ultimate control.

The plant produces abundant seed, and appears only to be stimulated by ordinary methods of cultivation. It is dangerous to stock of all kinds, as it contains an active principle which renders the skin exceptionally sensitive to sunlight, causing fever and itching, and resulting finally in bleeding and swollen surfaces from rubbing or scratching. Sheep can eat the young shoots provided they get a plentiful admixture of grass. For small patches of the weed the use of salt is the most effective method of eradication; but this method is far too costly for large infestations.

Generally throughout Europe during the summer of last year this plant, like most others, was remarkably free from insect enemies, the principal cause being the heavy mortality among insects during the late frosts of April and May. In many places, however, especially late in the season, considerable damage by insects became apparent. A study of the various insects causing different types of damage to the plant showed clearly that the genus *Hypericum* possesses a fairly large insect fauna attached to it, and a very large proportion of these insects appears to be entirely confined to the genus.

The assumption underlying this report is that the attempt to control St. John's wort by its insect enemies may safely be made in Australia

and New Zealand, provided that it can be shown (a) that the insects recommended for introduction will not feed at any stage of their life-history upon plants other than those of the genus *Hypericum*, and (b) that the same insects, if introduced into Australia or New Zealand, have a reasonable chance of controlling the weed.

These two points can be well secured if the same set of regulations already made with respect to blackberry-feeding insects are applied in the case of *Hypericum*-feeding insects also. (See this *Journal*, February, 1927, p. 84.)

The following are the most important species of insects attacking *Hypericum* in Europe :—

INSECTS ATTACKING THE LEAVES.

(1) *Chrysomela hyperici* and *C. varians*.—These two beetles are the most noticeable of the insect enemies of *Hypericum*. Both occur widely in Great Britain, *C. hyperici* apparently being the commoner. Both are double-brooded and pass the winter in the adult stage. First-brood larvæ are found in June–July, and second-brood larvæ in August–September. The second brood is known to be oviparous, but the first brood has been stated to be viviparous. This type of life-history is of great importance in considering the probable value of the insect under Australian or New Zealand climatic conditions. In these warmer climates it may reasonably be expected that a race would soon develop with a much shorter hibernating-period, a larger number of broods per annum, and complete viviparity, thus shortening the time between broods. Thus the rate of increase of the insect might become enormous, and the chief problem to be faced would be the possibility of such a ravenous leaf-feeder attacking other species of plants.

Miss Patterson, B.Sc., of Cambridge University, undertook at my suggestion to study these two species as part of her work for her doctor's thesis, and this work was to be continued into 1927. She has already tested the adult beetles, chiefly the commoner *C. hyperici*, on a large number of plants, and so far they have shown complete inability to eat anything but *Hypericum*. They feed most freely on *H. perforatum*, but on the cultivated garden species with larger and tougher leaves (*H. Androsacmum*) they do not thrive at all well. Owing to the great mortality among Miss Patterson's specimens, most of which died during these "starvation tests," the supply of larvae was somewhat limited. She proposes to continue these tests on both beetles and larvæ, and has been asked by me to report definitely, at the end of her work, as to whether these insects do, at any stage, attack any other plants except *Hypericum*, and, if so, what plants.

Assuming, as seems probable, that the experiments at Cambridge give a favourable result for these tests, I am most strongly of opinion that both these species, and, if possible, other allied species found in Europe but not in Great Britain, should be imported into Australia and New Zealand and tested out under strict control conditions in closed insectaries. A liberation of any species of *Chrysomela* in infested areas can only be made after the most exhaustive and thorough tests have been carried out as to the capacity of these insects to attack any other plants of economic value under the new conditions. If

these tests show an entirely negative result, then I believe that these beetles will prove of great value in helping to control the pest.

(2) *Anaitis plagiata* and *A. effumata*.—The first of these is a fairly large Geometrid moth known as the "treble-bar"; the second is a closely allied species often confused with it and very difficult to distinguish from it. The larvæ are looper caterpillars which feed voraciously on the leaves and also sometimes in the flower-heads of *Hypericum*.

Although all the text-books give *Hypericum* as the only food plant of these species, yet I have collected a considerable amount of evidence to show that the moths appear very commonly in localities where *Hypericum* is rare or absent. It seems highly probable that the larvæ eat other plants also. Consequently I must stress the importance of original research work being done in England on these species, in order to discover on what plants besides *Hypericum* the larvæ feed. Supplies of *A. plagiata* can be readily purchased from dealers, but I am strongly of opinion that no attempt should be made to introduce this moth or its allied species until a complete series of starvation tests has been carried out.

(3) *Actinotia polyodon* Cl. (= *A. perspicillaris* L.).—A Noctuid moth with a voracious larva which feeds on the leaves and flower-heads during July and August and hibernates as a pupa. It does not occur in Great Britain except as an occasional immigrant, but is widespread on the Continent of Europe. It should prove a most valuable aid in checking the weed, but much would depend upon how far it became subject to the attacks of parasitic Ichneumons and Tachinids already present in Australia or New Zealand. Supplies of the pupæ would have to be obtained in Central Europe.

(4) *Tineoid Moths attacking Leaves and Shoots*.—Quite a number of these are known, including the following species in Great Britain: *Depressaria hypericella*, *Gracilaria auroguttata*, *Epinotia hypericana*, and *Aristotelia atrella*. The first-named species spins the shoots together and does considerable damage when abundant; it may be considered of distinct value in preventing flowering of the plant. Much needs to be discovered about the life-history and food plants of these small moths before they could be considered as possible introductions into Australia or New Zealand.

GALL-FORMERS.

Hypericum is attacked by a number of gall-forming species, the most important of which are the Diptera *Perrisia hyperici* and *P. serotina*. Both destroy the flowering-shoots, the former making a rosette of a number of unfolding leaves, while the latter attacks only the two terminal ones. *Perrisia braueri* is exceedingly promising, as its larva stops the shoot while still underground. These insects are commonest in fairly warm localities in Europe, and should do remarkably well in Victoria. As their galls are quite characteristic and confined to *Hypericum*, immediate importations may be recommended, provided that they are received into closed insectaries and subjected to severe food tests before any decision is taken about liberating them. If the

attempt to establish them proved successful I am of opinion that they would almost completely prevent the plant from seeding.

SEED-CAPSULE FEEDERS.

I have seen a larva feeding in the seed-capsules in Central Europe which appears to me to belong to a species of *Apion*, probably *A. brevirostre*, which has been recorded as feeding only on *Hypericum*. Larvæ of *Apion* are most effective in destroying the growing seeds within the pods and capsules, and an insect of this sort, if confined to *Hypericum*, would be of the highest value.

RECOMMENDATIONS.

In view of the above facts, I desire to make the following recommendations :—

(1) That the policy of attempting to control *Hypericum perforatum* in Australia and New Zealand by means of its insect enemies should be officially recognized as a sound policy scientifically, offering very promising chances of final success.

(2) That arrangements be made for as complete a study as possible of the life-histories of *Hypericum*-feeding insects, to be carried out in England.

(3) That starvation tests for these insects be made on all important economic plants common to Europe and Australia or New Zealand (introduced).

(4) That only such species as give negative results in the tests (3) on all plants except species of *Hypericum* should be permitted entry into Australia or New Zealand.

(5) That species brought in should be reared in closed insectaries under the strict control of experts, and that they be subjected to further starvation tests on Australian or New Zealand plants of economic importance.

(6) That only such species as (a) give a negative result with these latter tests, and (b) appear from their habits in the insectary to promise useful results in controlling *Hypericum*, should be finally experimented with in infested areas in the open.

ACKNOWLEDGMENTS.

I desire to thank Dr. J. W. Heslop Harrison, of Armstrong College, Newcastle-on-Tyne, and Mr. H. C. Richards, M.A., of Brasenose College, Oxford, for valuable assistance in completing the list of insects known to attack *Hypericum*.||

" We must encourage and extend methods of timber-cutting which perpetuate the forest while harvesting its products; we must plant trees in abundance on our idle land where they can profitably be grown; we must examine taxation practices that may form economic barriers to timber-culture; we must encourage the extension of forest-ownership on the part of municipalities, counties, and other local governments; and we must take common counsel in public meetings to the end that the forestry problems of each region may be well considered and adequately met."—*President Coolidge*.

GORE EXPERIMENTAL AREA.

NOTES ON OPERATIONS, SEASON 1926-27.

R. MCGILLIVRAY, F.L.S., Instructor in Agriculture, Invercargill.

FROM the demonstrational aspect the season of 1926-27 at the Gore Experimental Area may be said to have been a record one. From October right on until May hardly a day passed without some one interested in the work visiting the area. At times farmers came in parties, and during February a field-day arranged by the Gore Branch of the Farmers' Union was largely attended. The season's programme was a fairly comprehensive one, but manurial trials and investigations of certain plant-diseases under field conditions received prominence.

OAT-SMUT CONTROL.

An experiment on the incidence of smut in oats under several different seed-treatments was watched with interest. The experiment was arranged in four replicated plots, representing (1) bluestone, (2) formalin, (3) hot water, (4) control. The result, as ascertained in January, was an appreciable amount of smut in the controls, a trace in both the bluestone and formalin treatments, while the hot-water treatment gave a crop that was clean throughout and more vigorous in growth than the others.

POTATO-SELECTION AND DISEASE-CONTROL.

A considerable amount of work was undertaken in connection with the potato crop. The selection of a pure line of the Up-to-date variety has been carried a stage further, and the foundation stock at Gore is now probably 100 per cent. pure. This line will be planted next season, and it is hoped to have a considerable quantity on hand in 1928. There has been considerable demand for this seed, but it has been impossible to distribute any this season.

In the control of corticium disease further work was undertaken by Mr. J. C. Neill, Field Mycologist. A number of new dry-powder treatments were tried, but none of these proved at all effective. The continuation of last year's treatment of the tubers with mercuric chloride and hydrochloric acid proved highly satisfactory, however, and these potatoes were a splendid sample. Definite yield trials will be undertaken next season, when the clean potatoes will be tested against seed affected with corticium.

LIMING DEMONSTRATION.

Two blocks of Scotch tares and oats, sown at the rate of 1 bushel tares to 2 bushels oats, gave a further demonstration of the value of lime under Southland conditions. One crop was grown on a part of the area that had received 2 tons carbonate of lime per acre, while the other was on unlimed land. Both crops were manured with super and Ephos phosphate at the rate of 1 cwt. per acre of each fertilizer. The difference in growth was very much in favour of liming. The

weight of hay on the limed block was 2·7 tons per acre, while on the unlimed area the hay-weight was only 1·5 tons per acre. Small birds caused much damage to the oats. The experiment was a useful one, and of much interest to those concerned.

SWEDE AND TURNIP TRIALS.

A considerable area was under various swede trials. The first was a variety trial conducted to ascertain yield per acre and possible resistance of individual varieties to disease (dry-rot and club-root). The crop throughout was manured with superphosphate at the rate of 2 cwt. per acre. All varieties were weighed and carefully examined. Vilmorin's Purple-top White swede gave a result showing over 84 per cent. of bulbs free from disease. The quality of flesh was good, and the swede was a strong grower, but had badly forked roots. Other varieties showing disease-resistance were Stødsgaard and several Bangholm strains. The yield of Vilmorin's swede was over 41 tons per acre, this being 8 tons over any other variety in the trial. Several varieties did not produce any bulbs free from disease.

A block of about 4 acres was devoted to a super and super-and-potash test. In the early stages of growth the potash plots were considerably in the lead and could be picked out without any difficulty. In the weighing, however, the yields were found to be very even, results being as follows: Super (2 cwt.), 27·2 tons per acre; super (2 cwt.) and 30 per cent. potash (1 cwt.), 27·7 tons per acre.

A manurial trial of Crimson King swedes in which various phosphates were used was closely watched by farmers. In this trial single plots only were arranged, as there was not sufficient land available for replications; therefore the weights could not be compared in the usual way. All fertilizers were applied at the rate of 2 cwt. per acre. Results were as follows: Super, 25·0 tons; Nauru phosphate, 19·6 tons; Ephos phosphate, 27·7 tons; Seychelles phosphate, 21·2 tons; basic slag, 21·1 tons. Requests have been received for a continuation of this test next season. This will probably be done, but the number of plots will have to be increased so as to overcome soil variations.

A manurial trial of yellow-fleshed turnips was undertaken in connection with the disease investigations in progress at Gore. Irvine's Disease-resistant was tried out against Sharpe's Green-top Yellow, an ordinary commercial line which was used as a control. The manurial treatment consisted of (1) super, 2 cwt. per acre; (2) super, 2 cwt., and 30 per cent. potash salts, 1 cwt., per acre. The experiment consisted of two drills of each manurial treatment, and was replicated twenty-two times. Results were as follows:—

Variety.	Super.	Percentage free from Disease.	Super and Potash.	Percentage free from Disease.
	Tons.		Tons.	
Irvine's Disease-resistant ..	22·5	73·3	27·7	80·5
Sharpe's Green-top Yellow ..	22·0	72·9	28·0	82·0

This experiment was carried out on land that was used for oats and tares last year. Irvine's special turnip did not show any greater

immunity than Sharpe's Green-top Yellow. The crop throughout was a very nice one and has stood much feeding.

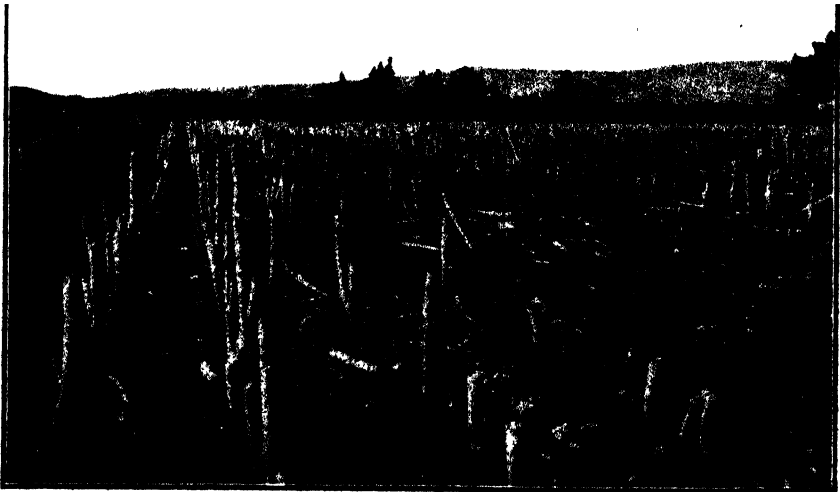
MANGOLD TRIALS.

The mangold block proved of interest to many visitors. Mangolds are not grown to any extent in Southland, but experience at Gore has shown that quite good crops of sound roots can be produced at a cost little higher than in the case of turnip-growing. A number of varieties were tested, and Sharpe's Selected Long Red Mammoth (34.62 tons per acre), Improved Large Yellow Globe (31.54 tons), and Dana Ovoid Giant (29.91 tons) were the heaviest yielders.

Part of this block was set apart as a manurial trial. The variety used was Golden Globe, and the treatments were—(1) Superphosphate, 2 cwt. per acre; (2) super, 2 cwt., and 30 per cent. potash salts, 1 cwt., per acre; (3) super, 2 cwt., 30 per cent. potash salts, 1 cwt., and dried blood, 1 cwt., per acre. These fertilizers were used in alternate drills throughout the experiment. At time of thinning, the plants that had received No. 2 treatment showed an increased top growth when compared with those that had received super only. The crops were weighed during the early part of June, with the following results: Super, 20.22 tons per acre; super and potash, 21 tons; super, potash, and blood, 22.35 tons.

CHOU MOELLIER.

The chou-moellier manurial-trial block at time of sowing was very badly infested with grass-grub. The manuring was as follows: (1) Superphosphate, 2 cwt. per acre; (2) basic super, 2 cwt.; (3) super, 2 cwt., and blood, 1 cwt.; (4) super, 2 cwt., blood, 1 cwt., and 30 per cent. potash salts, 1 cwt. Germination was good throughout, but



THE CHOU-MOELLIER CROP AFTER FEEDING OFF.

The two even rows on left are those in which potash was included in manurial mixture. Other rows uneven, caused largely by grass-grub damage.

the grass-grub did a great deal of damage in all plots except those in which potash salts were used. It was very noticeable that in the potash plots the growth was even throughout, while in the others many of the plants failed to make reasonable growth. The outstanding feature, indeed, was the greatly increased size of the plants where potash was used. At time of weighing they were, on an average, at least 18 in. higher and had more robust stems than the others. Fourteen replications of the experiment were made, and the average weight-yields for the various treatments were as follows: (1) 10.8 tons, (2) 15.5 tons, (3) 14.4 tons, (4) 22.0 tons, per acre.

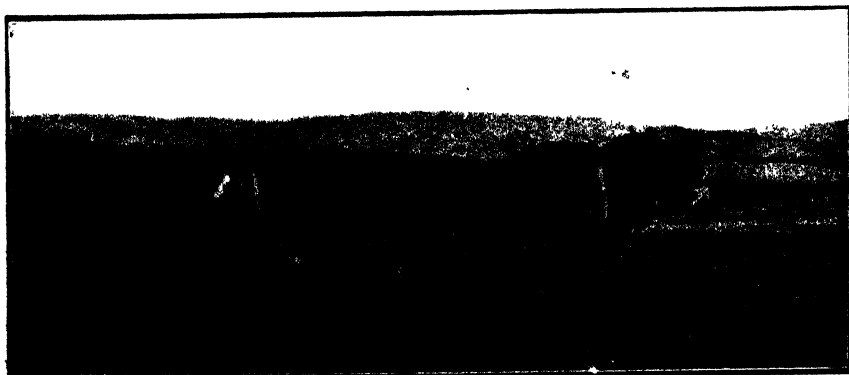
PERMANENT PASTURE.

The permanent-pasture block of ½ acres laid down last October is establishing well. One-third of the block was limed prior to laying down the pasture, and super at 2 cwt. per acre was applied when the mixture was sown. The grass made good headway, and grazing was commenced early in January. It was very noticeable throughout the season that the sheep frequented the limed part of the block to a much greater extent than the unlimed portion.

FERTILIZERS AND SEED-GERMINATION

It may be of interest to mention that in the case of all crops grown last season the germination was extremely good. Farmers have at times complained of poor germination when using the same fertilizer mixtures as were used this season on the Experimental Area. In all cases the procedure adopted when ridging is to apply the greater part of the fertilizer through the front spouts; in the case of potash salts and dried blood this material is applied from the front box of the ridger and does not come in direct contact with the seed at all.

The Overseer, Mr. James Sleeman, again carried out his many duties in an able manner, and great credit is due to him for the excellent condition in which the various plots were kept.



THE THREE-HORSE TEAM AT GORE AREA.

SEASONAL NOTES.

THE FARM.

TILLAGE AND EARLY CROPS.

IN a number of districts the rainfall has been fairly heavy and constant this winter, and in consequence tillage has been held up, more especially on the heavier soils: but, no matter how urgent the case may be, work should never be attempted on average land while in a sodden condition, even if cropping plans have to be altered. The texture of many classes of soil is easily spoiled and generally difficult to recover if so treated. However, no opportunity should be neglected when conditions permit to make up for arrears of work.

Land intended for spring-sown cereals should receive first attention. Suitable varieties of wheat may be sown during August, followed by oats and barley — dates as between August and September being governed by local conditions. The seeding, of course, should be rather heavier than for autumn sowing. Seed should be previously treated with copper carbonate, formalin, or bluestone for the control of fungus diseases. The crust formed by winter rains on autumn-sown cereal crops should be broken up with the harrows. This will leave a soil mulch which will dry quickly, leave the surface in a loose condition, and help to prevent the moisture, rising from below, reaching the surface and so being lost by evaporation.

In planning for useful autumn fodders past experience should guide the farmer as to requirements. In localities where there is risk of shortage of pasture ample provision should be made, choosing a portion of crops that may be turned into hay or ensilage later if not required earlier. Crops such as oats and tares, Western Wolths, ryegrass, and clover, millet, maize, &c., although primarily intended to tide over late summer or autumn requirements, can be conveniently utilized and stored for future use, according to variety, either as hay or ensilage. The provident farmer always overestimates the requirement of his stock and underestimates the yield of his crops.

Where root crops are to be grown in the spring after grass, the land should be ploughed as soon as conditions are favourable. A frequent stirring with the tine harrows is of great value in conserving moisture and checking weed-growth. For mangolds the grass should be skim-ploughed, the sod well disked, and this followed by a deep cross-ploughing. By these means the rotting turf becomes well associated with the soil.

In the case of all spring-sown crops superphosphate alone, or in combination with certain other manures, should be used. A quickly soluble phosphate is necessary so as to ensure vigorous early growth.

PASTURES.

In the North and other early districts spring top-dressing may be commenced during the coming month. Where lime was applied in the early winter, a dressing of 2 cwt. superphosphate will give the pasture an early start. Where heavier and moister conditions obtain,

and liming has not been done, basic super will generally be better. In all cases, whether before or after top-dressing, the vigorous use of the tripod harrows is invaluable in pasture-management.

Young grass should be very carefully treated at this time of the year, because the roots have not yet become firmly established, and close continual grazing will mean lack of vigour later on. Sheep, with their close feeding, are especially harmful if left on the pasture too long. In one sense they are the best for feeding down young grass, because they tread the ground evenly and their manure is well distributed, but their grazing should be managed with care. There is always a temptation to allow stock to graze too closely at this time of the year, but the farmer who can save his young grass by utilizing catch-crops, or by feeding out hay and mangolds on dry pastures, will reap the benefit later on.

LIMING.

In South Otago and Southland lime should be put on the land during July and August, so that its beneficial action may be experienced during the ensuing spring. On the heavy raw types of soil ground burnt lime can be most advantageously used, dressings of 15 cwt. per acre generally sufficing. On the lighter lands carbonate of lime (finely crushed) is advised, to be applied at the rate of 30 cwt. per acre. The practical soundness of liming in these districts is well recognized, and the present cheapness of lime should be an incentive to local farmers to top-dress a good acreage.

In the Auckland Province where lime is to be applied to grassland the month of July is a favourable time for the operation. The liming should be followed up by a top-dressing of superphosphate during spring. It is doubtful whether such liming is economical at the present time unless phosphates are applied afterwards or mixed with the lime. Lime must not be regarded as a substitute for fertilizer, although most soils are deficient in the former element, and until this deficiency has to some extent been satisfied superphosphate will not give its maximum effect. Those farmers who are in the habit of applying super year after year would certainly benefit by giving their pastures a dressing of 15-20 cwt. carbonate of lime per acre. It would hardly be possible to lime the whole farm in one year, but if, say, one quarter of the area is treated in this manner annually the result should be reflected in better pastures and healthier stock.

LUCERNE.

The cultivation of lucerne should be carried out before growth commences, and a top-dressing of superphosphate, with a little sulphate of potash added, will give a stimulus to the crop. Especially is this treatment necessary where it is intended to take a seed crop. An old stand can be disked if the straight cut is used, or cultivated with an implement having special lucerne points fitted. Young stands should be more carefully treated, although the harrows will do a great deal of good if used during the coming month.

FIELD DRAINAGE.

The outlets of all tile or mole drains should be looked to occasionally and any obstruction cleared away, likewise blocks in open drains. The

advantages of a well-drained field are particularly noticeable in late winter and early spring. Efficient drainage means the comfort and better health of stock, the earlier and better growth of crops and consequent higher yields, the better utilization of applied fertilizers and lime, earlier and greater activity of useful soil bacteria, and better assurance against the effects of dry weather.

—*Fields Division.*

THE ORCHARD.

SPRAYING.

OVERHAUL of the sprayer before the spraying season commences may save orchardists much loss of time and inconvenience later in the season. A thorough examination should be made of the machine, and all damaged or worn-out parts repaired or replaced. The moving parts of the pump and engine should be thoroughly cleaned and re-greased, and the hose examined and tested. A supply of spare parts for repairs in case of emergency during the season should be obtained.

The first essential in treating insect or fungoid diseases is that the grower should correctly identify the pest and know something of its life-history, in order that it may be correctly classified and the proper remedies applied for its control. Of the many books published with reference to this subject which would be an acquisition to an orchardist's library, if he has not already copies, are "Fungous Diseases of Fruit-trees in New Zealand," by G. H. Cunningham, and "Manual of Fruit Insects," by Slingerland and Crosby.

The remedies most commonly used are briefly as follows:—

(1) Poisons for chewing or biting insects. An arsenical poison (arsenate of lead) which acts upon the stomach is the specific in general use for the control of codlin-moth, leaf-roller caterpillar, and pear or cherry slug, &c. Such sprays should be applied to the foliage and fruit just before the pest is due to make its appearance.

(2) Contact sprays for sucking-insects: The insects must be present when these sprays are applied, and the specifics are most efficient when they come in contact with the bodies, or are inhaled through the breathing-organs of the insects. At the present time lime-sulphur, Black Leaf 40, and red oil are in most general use as contact sprays for the control of red mite, apple leaf-hopper, aphid (woolly, green, and black), and scales.

(3) Fungicides for the control of fungus diseases: The specifics should be applied before the spores of the fungus have an opportunity of establishing themselves on the plant or fruit tissues. Lime-sulphur, bordeaux mixture, and precipitated sulphur are the fungicides in most common use for the control of black-spot, powdery mildew, leaf-curl, brown-rot, and other fungus diseases.

(4) The use of the secateurs and the saw for cutting out, where practicable, parts of trees badly damaged by insects, fungi, or bacteria.

A full detailed spraying schedule was published in the *Journal* for August and September, 1926.

CULTIVATION.

If the land has not already been ploughed every effort should be made to complete this work as soon as possible, so that cover-crops, grass, and fallen leaves, &c., may be turned in. This will give the material time to rot and be made available when the tree requires it in the summer, while the fruit is maturing. Leaves affected by disease, such as black-spot, will be buried and have rotted, thus preventing the dissemination of disease from this source during the spring.

GRAFTING.

This operation is done in spring when the sap has commenced to rise in the stock. Scions for grafting are usually selected as soon as the growth is dormant, and stored away in a cool, damp place, which should not be wet; or they are heeled into a similar position, where they are kept until the stocks are ready to be grafted in spring. Where cool-storage facilities are available it is recommended that the scions be placed in a chamber having a temperature a few degrees above freezing-point. The leaving of the scions on the trees until just prior to bud-movement is recommended in some quarters, and has been practised with good results.

FERTILIZERS.

Those growers who intend using fertilizers in the orchard during the coming spring should order their supplies now, so that these may be on hand when the time comes to apply them. In districts which experience dry springs and summers the fertilizers should be applied this month. In normal soils from 5 cwt. to 7 cwt. per acre of fertilizer should be sufficient, and in the lighter and poorer soils as much as 12 cwt. will be required for bearing trees. Particulars of manures and their application were given in these notes for May and August last. The fertilizer should be broadcast evenly throughout the orchard, or over that portion of it which is to be treated.

PLANTING.

Growers intending to plant in the spring should arrange for early delivery of the trees, and on their arrival they should be heeled into a suitable place on or near the ground, ready for planting toward the end of August. The ground should be reasonably dry, and, if wet, the planting should be delayed until a later date, when the soil is in a suitable condition.

SHELTER.

Shelter for the orchard is indispensable. In situations which are subjected to severe windstorms and where a wind-break has not yet been established the matter is of such importance that the present planting season should not be allowed to pass without something being done. Gaps in existing shelter-belts should be replanted.

—W. K. Dallas, Orchard Instructor, Dunedin.

Citrus-culture.

Harvesting: Routine work among established trees will consist of harvesting fruits as they become ready. With lemons {this should be done as the fruit attains size rather than colour. A silver-green

to light-yellow tinge of the skin is quite a satisfactory colour at which to pick, providing the diameter of the fruit approximates $2\frac{1}{2}$ in. to $2\frac{3}{4}$ in. The fruit should be cut with a small portion of the stem attached, which should be trimmed off at the button, otherwise there is a likelihood of the stem puncturing other fruits on contact in the picking-bag or fruit-case. Care should also be observed in handling the fruit, as any form of skin puncture or bruise rapidly causes its loss. The fruit will, of course, require to be cured and stored to obtain marketable condition, but it becomes a far better marketable article than thick-skinned, tree-yellowed fruit.

Oranges may, with advantage, be allowed to remain on the tree longer than is the present general practice. Sweet oranges in particular should be allowed to hang several weeks after full colour is attained. During this time a certain refinement of the skin takes place, and the fruits take a full flavour. According to variety, Poorman oranges, if intended for sale as preserving-oranges, may be picked as soon as reasonable size together with pronounced colour is attained, as superior preserves are made with fruit in a rather undersized state. The larger fruit intended for sale as "breakfast" fruit should be allowed to hang on the trees until well mature, in which state they will meet with more general approval. This will assist towards popularizing the fruit for table purposes, whereas under-ripe fruits with a bitter flavour tend to restrict sales.

Planting: With the approach of the planting season efforts should be directed towards putting the land in order to receive the trees. Good drainage is essential, as unless this is natural or provided artificially trees cannot be expected to thrive. A thorough working of the soil and first subsoil is also advisable, but should be done uniformly over the whole area, not, as is often considered sufficient, under the trees only. Where the subsoil is disturbed in such a limited area only it really acts as a water-catchment basin, and the trees are harmed rather than assisted. General surface-levels should also be attended to, grading being so done as to prevent depressions likely to hold water.

--W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

HATCHING AND REARING OF CHICKS.

AUGUST is one of the busiest months on the poultry plant, for it is then that the work of hatching and rearing chicks should be carried out as rapidly as possible. No chickens do so well as those which start off when the grass and other plant-life commences to grow, and which have the opportunity of making their chief development as the days lengthen. Late-hatched chicks are usually unprofitable because, in the first place, the needful robustness is seldom or never secured, and thus the proportion of birds which must be culled is unduly high. They are also more subject to adverse conditions than the birds bred in the early spring. It stands to reason that

when hatched in the warm weather, and coming on to the colder months before maturity is reached, the highly bred egg-type of pullet is called upon to face conditions which put too severe a strain on her, especially if she is not protected in every way from climatic extremes of weather.

Hatching stock late in the season is not only against satisfactory development, but means poor egg returns and the encouragement of disease. Therefore, whenever possible, all eggs intended for hatching purposes should be placed in incubators or under broody hens by the end of August, or early in September at the latest. In cases where the natural mother is depended upon for hatching and rearing, the difficulty of securing early chickens is often a vital one, owing to inability to secure broody hens when required. There are two alternatives—either to procure an incubator or secure day-old stock. The latter method is by no means to be despised, especially when the supplier is a man of repute and furnishes a reliable fireless brooder with the chicks.

In connection with the work of brooding, it is most advisable to open up any chicks that die, in order to ascertain if possible the cause of death. Investigations of this kind are not only interesting, but they often give clear proof of the cause and nature of the trouble, and indicate necessary preventive methods. Thousands of chicks die annually through eating long fibrous green material and pickings from curtains, sacking, &c., which roll up in a tangled mass in the gizzard. Much mortality also takes place among chicks when they are supplied with grit or bedded with sand containing a large proportion of glittering mineral particles, which they pick out. These particles accumulate in the gizzard, and death rapidly follows. Many of the brooder losses could be prevented if these injurious substances were kept out of the reach of the motherless chicks that have not attained the age when they can be trusted to look after themselves.

Some of the so-called wheat-pollard containing a high percentage of fibrous material, such as finely ground husks, is also often responsible for heavy losses in young chicks. Several such cases came under my notice towards the end of the last breeding season, when hundreds of chicks from three to five weeks old were lost from no other cause. Although finely ground, the fibrous material contained in the pollard would not leave the gizzard. As a result this organ became packed to its utmost with the fibrous substance, and consequently the chickens died from starvation. Young chicks have not the power to assimilate hard fibrous material, however finely it may be ground. Obviously, to compel young birds to eat any mixture containing a high percentage of this material is simply courting disaster. Unless pollard is known to be the genuine article it should never be included in the ration for birds of any age, and particularly is this the case where growing chickens are concerned.

Brooding Hints.

In artificial rearing the importance of preventing the chicks from being chilled cannot be emphasized too strongly. Chill is the most common cause of bowel trouble, and once this sets in little or

nothing can be done to save young birds. Overheating on the one hand, and underheating on the other, are probably more responsible for chill and its evil effects than all other things put together. Very often when mortality takes place the food, the brooder, or some mysterious disease is blamed for the trouble; but it is safe to say that in nine cases out of ten a chill is responsible and nothing else. The temperature should be so controlled that the chicks can secure that uniform degree of warmth which instinct demands, quite irrespective of what the prevailing weather conditions may be. It is only the person with an observant eye, and one who can anticipate the little birds' requirements, who can really steer safely between the danger of either overheating or underheating.

As to the temperature to be maintained in the brooder, there is no better guide than the behaviour of the chicks themselves. If they are well spread out and look comfortable it may be taken for granted that the heat is correct. On the other hand, if they are seen to be huddling, more warmth is required; while if the heat is too great they will be gasping for breath, with wings spread out to a lesser or greater degree, and thus when they leave the brooder they are highly susceptible to chill. In addition to having a comfortable degree of warmth, the brooder must be arranged in such a way that pure fresh air is available to the chicks at all times. Nature should be followed in this respect. The mother hen not only sees that the young ones are kept under her body in a correct temperature, but the chicks are also given the opportunity of breathing fresh air, that great essential for their welfare.

Of course, chickens may become chilled from causes other than that of an incorrect temperature in the brooder. It is often due to removing them too soon from the incubator, or to giving them too much liberty the first few days. Chicks are most susceptible to chill during the first week, and up to this age they require special care and management. They should be confined to the brooder for the first three days, and then given only a small area to exercise in, otherwise they are apt to lose their bearings, huddle away from the brooder, and receive a chill. Above all, the chicks should be protected from draughts; if they are subjected to a direct draught, whether by day or night, trouble may be expected. A common mistake made is to let the stove or lamps go out on hot days. Remember that the hen gives her brood a warm-up frequently, quite irrespective of the prevailing weather conditions, and this until they have attained an age of several weeks. Do not be tempted to overcrowd the chicks. This is bad enough in any branch of the plant, but it is especially disastrous with the young tender stock. Always remember that a hundred chickens well reared will return a better profit than double the number indifferently cared for.

Leg-weakness.

If the chicks are losing the power of their legs and developing a wobbling walk it indicates they are huddling at night and require more warmth. This trouble is often intensified by the lack

of sufficient bedding on the brooder-floor, especially when the floor is very smooth. The constant slipping on the smooth surface in their endeavour to secure an inside position, which is the warmest, has the effect of spreading and weakening the delicate legs. On the first sign of this condition being observed additional warmth should be applied, by extra flame in a heated brooder, and extra covering in the case of a fireless brooder. Another preventive method is to first cover the floor of the brooder with a thin layer of chaff—say, $\frac{1}{2}$ in. deep. On this place a piece of single sacking the full size of the brooder-box, and cover this with straw chaff (not oaten chaff) to a depth of about 1 in. This will not only provide a comfortable bed for the chicks and induce them to spread out, but it will also greatly assist in preventing them from slipping, with its consequent bad effects on their legs.

Feeding.

What to feed chicks on is largely a question of local conditions, as there are numbers of mixtures that will give equally good results, and where only a small number of chicks are to be reared the best brands of these foods will fulfil all requirements so far as a grain meal is concerned. Remember that it pays to feed the best preparations quite irrespective (in reason, of course) of their price.

Strict attention to cleanliness is of the utmost importance. The quarters, drinking-vessels, feed-trays, troughs, and litter must be kept clean, that great essential for preventing insect pests and disease from making their appearance.

—F. C. Brown, Chief Poultry Instructor.

THE APIARY.

EARLY SPRING OPERATIONS.

As spring arrives every advantage should be taken of fine days to examine the hives and to give the apiary a general clean-up. No season is better for this than spring, just at the time when activity begins among the bees. In the process of examination every hive should be opened, one at a time, and its condition noted. See that the queen is present, note the progress made in brood-rearing, and be sure that sufficient stores are on hand to meet the incessant demands of the colony. Should there be plenty of honey still in the combs—say, from 15 lb. to 20 lb.—this will answer, but, if not, artificial feeding will be necessary to supplement the honey coming in from fruit-bloom and early spring flowers. The best way to replenish the stores, if combs of sealed honey from healthy colonies are not on hand, is by the use of a syrup made from the best white sugar. A syrup made in the proportion of one part of sugar to three parts of water can be used. Heat the mixture until the sugar is dissolved, but exercise care to prevent the mixture from burning. Feed inside the hive. For full particulars see Bulletin No. 128, "Beekeeping," published by this Department.

FRAME MAKING AND WIRING.

Frame-making should receive every consideration, and proper nailing must be strictly attended to. There are no short-cut methods to the proper nailing of frames, and neglect in this direction will undoubtedly cause a great deal of worry when the frames are in use, more especially in districts where the bees bring in a great deal of propolis. It is well to take every precaution that there is no danger of the top bar leaving the sides of the frame when manipulating heavy combs.

Strict attention must be given to wiring the frames. Many good combs are broken at the time of extracting through neglect to wire properly, and good wiring will allow the beekeeper to handle the combs freely without fear of the brood and honey falling out of the frame. The end bars usually contain three holes through which to thread wires. Cut the wire in lengths of about 60 in., and thread through the holes, draw tight, and fasten each end with a small tack. Some beekeepers advocate single wires in case the long wire gets broken, but if good wire is used the former method will prove satisfactory.

FITTING FOUNDATION IN FRAMES.

When fitting the foundation in the frames care must be taken to see that the sheets are properly sunk into the groove provided. Slip the sheet of foundation through the wires so that the centre one is on one side and the top and bottom one on the other. Put the foundation in the wide groove, and the wedge, which should be broken in two pieces at least, in the narrow one. Sink the wedge, thus forcing over the tongue against the foundation, which will then be in the centre of the frame. This is a most important matter, as the correct position of the foundation alone ensures even combs. In order to make the foundation more secure a simple operation may be performed by the use of the spur-embedder. This small appliance forces the wires firmly into the foundation. It may be purchased for a few pence at any of the dealers. A good method of securing the wires is to bring into use melted beeswax. The wax when molten may be applied to the wires by means of an ordinary paint-brush. The latter method is quicker, and prevents any danger of the wire cutting the foundation, as sometimes happens when the embedder is used with too much force.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

LAND TREATMENT AND CROP ROTATION.

THE suggestions made in these notes, under this heading, in March last now demand further consideration, as the plans there set out have now arrived at the planting stage. A common practice with market-gardeners and fruitgrowers is to give very heavy dressings of chemical fertilizers before planting or sowing the crop in the spring—sometimes even after heavy dressings of organic manure in the autumn. This treatment is justified, it is considered, by the size and number of crops that are taken from the land, and what is not used by the crop remains in the ground and so forms useful reserves. Crops grown under this treatment are often very good, but there is a great deal of evidence

to show that they would be as good with a much smaller application of fertilizers, and sometimes even better. An amount of 5 cwt. per acre of chemical fertilizers, even without a green crop turned in or organic manures applied, is a good heavy dressing, and needs to be exceeded only rarely on any one occasion. In the spring, before sowing or planting, 2 cwt. or 3 cwt. of superphosphate per acre, and about half that weight of sulphate of potash, is a useful dressing for the land for most crops. The essential ingredients are very soluble and readily available. What else is needed is best given as required, and one accustomed to estimating the condition of crops will very soon decide what that may be. The method of applying moderate doses at intervals—especially when well selected—has proved the best method and more economical. There are cases where a plant will suffer from the application of manures that would be decidedly beneficial at the proper season. The best results, with a greater economy, lie along such lines as the foregoing.

Land under preparation is cleaned by turning in the existing vegetation to rot. After about a fortnight seedlings will make their appearance with twitch and similar plants. A light stroke of the hoe or cultivator on a fine day will destroy these, and after a second or third repetition of the treatment the crop has an excellent chance of getting established with little trouble to the grower, as the weeds are more readily destroyed now before the seed is sown; also the land has time to consolidate, as is necessary for a good seed-bed. There is the further not unimportant advantage of destroying those insect pests which pupate in the soil, thus eliminating them before they can damage the crop.

VEGETABLE CROPS.

The first opportunity should now be taken to complete the sowing of the earlier vegetable crops mentioned last month. Broad beans, peas, lettuce, spinach, cabbage, cauliflower, parsley, onions, short-horn carrots, parsnips, white turnips, turnip-rooted beet, and radishes are all in keen demand, many of them for spring and early summer use. In most districts, on well-drained land, they should be sown as soon as the land is sufficiently dry.

The planting-list includes early potatoes, artichokes, autumn-sown onions, cabbage, cauliflower, lettuce, shallots, garlic, and herbs. Rhubarb may be included, although transplanting is sometimes deferred until after the crop has been pulled. Except in the warmest districts asparagus is best planted next month. Kumaras should be prepared for sprouting.

THE FRUIT SECTION: OUTSIDE AND UNDER GLASS.

The pruning, spraying, cleaning-up, and manuring of established crops should now be completed, also the planting of new brakes of bush fruits. Passion-vines and tree-tomatoes are best planted a little later. Seeds of tomatoes, Cape gooseberries, peppers, and egg-plants should be sown in boxes, and raised on a hotbed in a sheltered position.

Towards the end of August tomatoes and cucumbers are planted out under glass for early summer cropping. During the variable weather of early spring every care must be taken to prevent the

plants becoming chilled. A little ventilation will be required daily, but care must be taken to close the houses early in the afternoon; this is a necessary attention that is perhaps neglected more than any other at this season.

CROPS OF NUTS.

The growing demand for this produce is attracting the attention of planters. In many cases, instead of planting them in large orchards in the usual way, they may be distributed in hedge-rows, on waste ground, or the edge of plantations, or among the decorative planting about the house. The walnut prefers an open alluvial soil; the sweet chestnut, hilly country of fair quality. The hazel crops best on land of fair quality only; and the stone pine (*Pinus pinea*) does not appear to be at all particular as to locality. Although quite a number of these pine-trees have been planted and are in bearing, owners are often unaware that the seeds are edible, and more often still that they are a considerable article of commerce. They are very good.

SHELTER, HEDGE, AND ORNAMENTAL TREES AND SHRUBS.

It is well to remember that the short period during which these plants may be moved is drawing to a close. The end of September is as late as one can plant without serious risk, but it is safer to do it now, particularly if much of that class of work has to be done; to defer it is running too great a risk. After the selection and arrangement of the planting have been carefully studied, a dry soil at planting-time and secure fencing from stock are among the more important conditions necessary.

TOBACCO SEED-BEDS.

A large quantity of leaf ripening at the same time is difficult to handle satisfactorily, especially in the curing-shed and where the whole-plant system of curing is adopted. To spread the harvest period the seed-beds are sown at intervals. It is desirable to start the first in the coming month, in order that the harvest may commence early. The beds should not be more than 5 ft. wide, so that weeding and pulling may be done conveniently. In some cases this early sowing requires the shelter of glass sash-lights, and in some instances it is even given the assistance of a hotbed. Small experimental sowings can be made in seed-boxes in the usual way with annuals, the plants likewise being pricked out when they have made their first pair of true leaves, and allowed to grow till they are 3 in. or 4 in. high and ready for planting in the field.

To get over the difficulty of sowing such a fine seed evenly over a comparatively large area it is usual to mix it with about twenty times its own bulk of sifted wood-ashes, sand, or bonedust. After thorough mixing the material may be evenly distributed and pressed in the ground with a board or light treading, or it may be watered in lightly with a fine rose.

The seed-bed should then be covered with sash-lights, light hessian, or cheese-cloth. A close calico or hessian is sometimes used, but is unsatisfactory, as it creates a close, damp atmosphere

in which slime fungus grows, and the conditions are altogether unfavourable. The cloth is held 8 in. or 10 in. off the ground by a board kerb placed round the bed, with cross-battens at intervals to avoid sagging. Much judgment is required while the seeds are germinating, in order to keep the bed moist and warm while preventing the land becoming wet and sour.

It is also quite time to commence the preparation of the field where the plants are to be grown, if that has not already been commenced. The work is easily and effectively done now; if it is deferred and the plants are put out before the preparation is properly completed it can be neither.

LAWNS AND PLAYING-GREENS.

New lawns will require careful cutting, weeding, and light rolling. The grass must be cut high for the first season to allow the plants to become established.

Old greens will require the worn patches to be mended with suitable turf, the lawns carefully weeded, and a top-dressing of good quality and moderate quantity applied. There is serious danger here of introducing more weeds. Unless the soil used has had at least twelve months' preparation in a compost heap, it is safer to use a clean sand for mixing with the fertilizers for the top-dressing.

—W. C. Hyde, *Horticulturist*.

OPENNESS IN CHEESE, AND FACTORY HOURS.

SPEAKING on the subject of openness in cheese at the annual conference of the National Dairy Association last month, the Director of the Dairy Division, Mr W. M. Singleton, said:—

"As soon as the Division's laboratories are erected and the experimental dairy factory is available it will be possible to give greater attention to this question. Some of the openness in evidence is, however, merely that which has always troubled cheesemakers more or less, and is generally recognized to be due to unduly hastened manufacture. Many dairy-company directorates object to the payment of overtime. This has caused their managers to take risks in the process of manufacture which too frequently prove unsuccessful, and open cheese is the consequence.

"In most industries governed by fixed hours and wages for employees it is probably the case that the quantity of output is much in harmony with the number of hours worked. In the manufacture of cheese this is not the case, since the hours worked have little connection with the quantity of milk received, or the weight of the resultant cheese. Furthermore, with slow-working curds, the extra time required consists more of waiting-time than of time spent on actual work. The output per day, therefore, is practically the same whether the hours be normal, or more or less than normal. The difference from the company's standpoint is one of quality.

"Quality in our cheese, with special reference to 'openness,' is so important that one is constrained to suggest that the employers' representatives should strive to get the stipulation of number of hours left out of future awards or agreements in this connection. Provided the number of men for certain quantities of output be stipulated in a manner which is fair and reasonable, the question of hours may, in my opinion, be well left in abeyance. I cannot recall having ever met a manager who kept slow-working curds longer in the vat than he deemed necessary for the making of a close-bodied cheese. Moreover, if the factory-manager and his staff are continually working against time, as indicated by the present system, it is prejudicing the proper training of our factory-managers of the future. The factor of quality in the resultant cheese is being taken much less seriously under the present system than should be the case."

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR JANUARY TO JUNE, 1927.

Dairy Division.

OWING to the comparatively small number of cows generally which calve during the first half of the calendar year in this country, it is a more or less natural expectation that the number of animals receiving certificates of record during that period will be comparatively low. In the first half of 1927 thirty-nine cows were granted certificates as detailed in the appended list.

While numerically the list is by no means a strong one it contains several yields of more than average merit. The outstanding record, however, is that of Messrs. H. North and Sons' mature Friesian Rosevale Queen Sylvia Triumph, with a yield of 986.06 lb. butterfat from 23,091 lb. milk produced in 365 days, commencing at the age of 5 years 10.4 days. This cow has two other certificated records, one of 621.23 lb. butterfat in the junior two-year-old class, and the other of 589.60 lb. as a senior three-year-old. Her sire is Rosevale Plus Triumph, who, in addition to Rosevale Queen Sylvia Triumph, has five other C.O.R. daughters. Her dam is Rosevale Queen Daphne, who has gained three certificates of record—a junior two-year-old for 509.82 lb. butterfat, a junior three-year-old for 675.18 lb., and a junior four-year-old for 805.54 lb. Messrs. North and Sons may be congratulated on the breeding and handling for test of Rosevale Queen Sylvia Triumph, who appears to be but one of many cows from a herd of high-yielding, long-distance producers.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class	Tested by	Age at Start of Test	Fat req'd for Cert	Yield for Season		
				Days	Milk	Fat
JERSEYS.						
<i>Junior Two-year-old</i>		Yrs. days.	lb.		lb.	lb.
Vernon King's Noble	G. R. and H. Hutchinson,	1 306	240.5	300	7,628.3	418.57
Aster	Auckland					
Viola's Golden Life ..	J. Mitchell, Hopelands ..	1 336	240.5	285	6,717.9	376.34
Jenny Lind of Puketapu	T. H. Western, Bell Block ..	2 56	246.1	364	5,766.6	313.60
Beauheu Goldie ..	A. O. Brown, Kamo ..	1 314	240.5	273	6,017.3	286.13
<i>Three-year-old.</i>						
Superior Girl ..	John Hale, New Plymouth	3 72	284.2	305	9,445.4	515.90
Ursanne Bowhina ..	Martin and Murray, Temuka	3 257	302.7	351	8,308.8	481.77
Snow View Butter Girl	F. Phillips, Otorohanga ..	3 69	283.9	365	8,192.1	423.82
Myrtle Bright ..	S. J. Robinson, Hinuera ..	3 247	301.7	352	7,483.8	385.94
Braeside Bonnie ..	J. Mitchell, Hopelands ..	3 10	278.0	296	6,322.9	382.31
<i>Four-year-old.</i>						
Waipiko Clarity ..	C. G. C. Dermer, Waipiko ..	4 106	324.1	365	12,786.4	634.43
<i>Mature.</i>						
Snow View's Maiden	H. C. Sampson, Hillsborough	6 5	350.0	365	9,866.2	527.62
Orange Dale's Larkspur	W. J. Hall and Son, Matatoki	6 88	350.0	365	8,987.3	520.80
Meadowvale Petrova	S. J. Robinson, Hinuera ..	5 318	350.0	346	8,924.4	513.01

LIST OF RECORDS—continued.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cent.	Yield for Season		
				Days.	Milk.	Fat.
FRIESIANS.						
<i>Junior Two-year-old.</i>		<i>Yrs. dys.</i>	<i>lb.</i>		<i>lb.</i>	<i>lb.</i>
Pareora Butter Girl Cadillac*	A. S. Elworthy, Timaru ..	2 144	254.9	365	16,491.7	626.43
Totara K. P. Colantha*	Piri Land Co., Auckland ..	2 163	256.8	365	15,503.5	573.94
Merrylea Inka May Griselda*	McDonald and Co., Dunedin	2 156	256.1	365	13,803.8	496.37
Anawhata Hilda Minto Pietertje	P. F. Boucher, Kumeu ..	1 344	240.5	303	8,349.5	309.58
<i>Senior Two-year-old.</i>						
Rouble Pietertje Val-dessa*	Hobson Farm, Ltd., Auckland	2 266	267.1	235	8,598.2	348.53
<i>Junior Three-year-old.</i>						
Rosevale Gypsy Abbe-kerk Posch*	H. North and Sons, Omimi	3 127	289.7	365	16,734.2	523.26
Rosevale Inka Beauty Posch*	H. North and Sons, Omimi	3 80	285.0	365	15,938.0	430.99
<i>Senior Three-year-old.</i>						
Peria Julip Lass ..	Waitemata Stud Farm, Hobsonville	3 186	295.9	192	7,189.6	312.75
<i>Junior Four-year-old.</i>						
Rosevale Kaatje Colantha Posch*	H. North and Sons, Omimi	4 131	326.6	365	19,631.5	634.26
<i>Senior Four-year-old.</i>						
Rosevale Helena Keyes*	McDonald and Co., Dunedin	4 325	340.0	365	13,981.8	380.57
<i>Mature.</i>						
Rosevale Queen Sylvia Triumph*	H. North and Sons, Omimi	5 104	350.0	365	23,091.9	986.06
De Kol Lulu of Hawkridge*	Piri Land Co., Auckland ..	8 17	350.0	365	16,292.1	641.06
Rosevale Princessje*	H. North and Sons, Omimi	6 14	350.0	365	17,114.2	592.40
Cluny Pietje Kate 10th	Piri Land Co., Auckland ..	5 301	350.0	365	16,456.8	584.58
Cluny Princess Buttercup*	Piri Land Co., Auckland ..	5 326	350.0	365	17,892.7	582.61
Rosevale Kittie Posch*	H. North and Sons, Omimi	7 44	350.0	365	16,673.5	511.73
Woodcrest Netherland Pauline	Waitemata Stud Farm, Hobsonville	8 150	350.0	257	15,494.2	504.59
Blanco 4th Flush* ..	W. J. Polson, Fordell ..	7 337	350.0	365	11,684.8	403.93

MILKING SHORTHORNS.

<i>Junior Two-year-old.</i>						
Vale Royal Sunbeam	Simms and Sons, Ha'swell..	2 84	248.9	348	5,142.4	255.58

RED POLLS.

<i>Two-year-old.</i>						
Glen Eden Red Rose	J. G. Donaldson, Stirling ..	1 340	240.5	365	6,798.5	296.69

LIST OF RECORDS—continued.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat rec'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

*Second-class Certificates.***Jerseys.**

<i>Junior Two-year-old.</i>				Yrs.	dys.	lb.	lb.	lb.
Daphne of Stonycroft	S. Unwin, Winchester	..	2	27	243.2	365	5,172.2	318.45

Mature.

Bilberry's Nettie	..	J. R. Colson, Waihou	..	5	12	350.0	365	10,896.5	547.35
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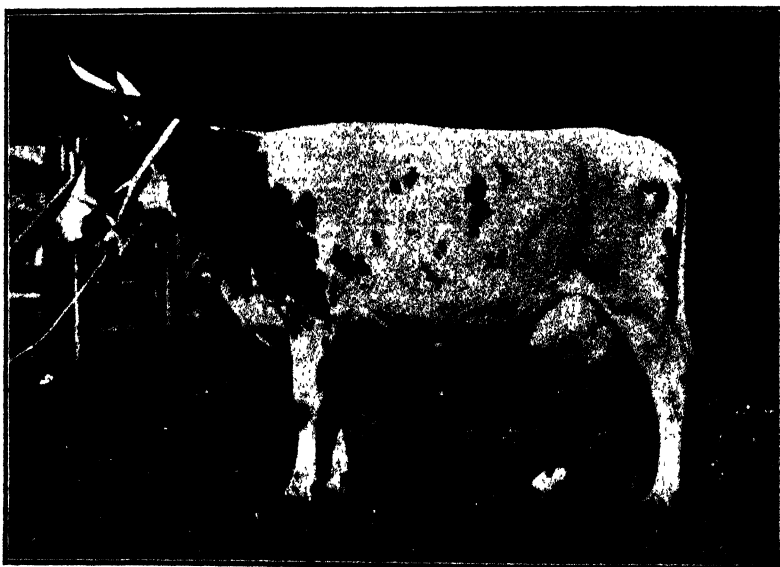
Friesians.

<i>Junior Two year-old.</i>									
Totara Lulu de Kol	..	Piri Land Co., Auckland	..	2	6	241.1	365	13,821.7	503.30

<i>Junior Three-year-old.</i>									
Ryvington Ruby	..	Mrs. A. M. Hodgson, Tama- here	3	28	279.8	364	12,263.3	407.68	

Mature.

All Dutch Queen	..	W. H. Madill, Auckland	..	10	250	350.0	365	19,867.4	796.02
Nepean Royal Colantha Pietertje		J. J. Walker, Ohangai	..	6	41	350.0	365	13,715.6	534.08



FLOSS OF BRAESIDE (R. W. D. ROBERTSON, NEW PLYMOUTH).

C.O.R., 1926, in Ayrshire mature class: 14,907.4 lb. milk, 678.88 lb. butterfat.

REVIEW.

"PLANT NUTRITION AND CROP PRODUCTION."

SIR JOHN RUSSELL, Director of the Rothamsted Experiment Station, Harpenden, England, was the fifteenth annual lecturer selected to deliver the Hitchcock lectures at the University of California, U.S.A., in 1924. These lectures have now been published (University of California Press, Berkeley, California, and Cambridge University Press, England, 1926) under the title "Plant Nutrition and Crop Production."

It goes without saying that the book is intensely interesting to students of agriculture. Sir John Russell has the happy knack of treating historical matter with freshness and originality, and when he takes one back to 600 B.C. or to A.D. 1620, or to other experiments of the seventeenth, eighteenth, and nineteenth centuries, it is all with the purpose of showing how the theories now held were laboriously built up, and each illustration fits beautifully into the scheme of his ordered instruction to his American audience. Treated in the lecturer's easy style the description of the development of the theories concerning agricultural chemistry centring round the great names of Liebig, Lawes, Gilbert, and Boussingault makes eminently good reading. The rise of the artificial manure industry, and particularly that of the great superphosphate trade, reads like a fairy-tale. Sir John concludes. "It is not too much to say that the discoveries and developments of artificial fertilizers have been one of the great factors in the making of modern Europe."

To review the whole field of his subject the lecturer has, in 115 octavo pages, succeeded beyond expectation. Sir John has much to say on nitrogen and soil bacteriology worthy of close attention, but on the questions of special interest to New Zealand students he must be fully quoted. "Probably the most dramatic effects, however, are those produced by minute quantities of certain elements, iron, boron, manganese, and a few others, on the growth of plants supplied with a complete nutrient solution. Small quantities of manganese were found by Bertrand to be essential to plant growth. Boron is being studied at Rothamsted, the investigation having originated in an observation made when the entomologists were adding various poisons, including borax, to soil in which broad beans were growing, in the hope of making the plant unsuitable to the *Aphis*. Borax markedly increased the plant growth, and when the botanical staff took the matter up they found that the old 'complete' nutrient solution would not allow beans to develop unless a trace of borax was supplied. Mazé, of the Institut Pasteur, Paris, has added other elements, iodine, zinc, aluminium, &c. to this remarkable list. The subject is under investigation by Dr C. B. Lipman. The analogy with vitamins is obvious, but analogy is the most treacherous method in science."

The difficulties of the investigator in getting his theories translated into farm practice are thus touched upon: "We shall find this to be the usual course of events. The first workers obtained much knowledge rapidly, then comes a period when progress apparently ceases and confusion reigns instead. Suddenly the generalization appears, and sooner or later thereafter the practical application. Then comes the large-scale test, the criticisms, and the curious and inexplicable observations of the practical grower. And although we who are working in the experimental stations may sometimes be tempted to feel that these observations, being unknown to us, cannot possibly be true, nevertheless, they often are true, and contain the germ of highly interesting scientific problems, sometimes, indeed, the key to further progress. We shall see in later lectures how history is repeating itself in other branches of science. But progress is always slow, and we can never see the whole of anything in nature; as Browning said, 'We explore with a taper and not with a torch.'"

Finally, the lecturer summarizes what is known regarding soils and their classification. Soils contain two phases. (1) mineral, from the rocks. (2) organic, from the decay of plants. In humid, cool conditions, as in New Zealand, the silicates of the rocks break down to form soils rich in silica, but in wet tropical conditions the silica is washed out, leaving only aluminium and iron oxides; and under still wetter conditions the aluminium is also washed away.

leaving the laterite red soil (chiefly iron compounds) of the tropics. The nature of the organic matter is determined by the vegetation from which it arose and the kind of decomposition to which it is subjected, both of which are dependent on the climate. Hence the soil is very much the child of the climate. An actual confirmation of this has been effected by American investigators who transported a soil from one district to another with different climate. In seven years considerable alteration was found in its composition.

The first great division of soils is therefore into the laterite and silica soils. The second great division is determined by the presence or absence of reactive calcium. "In the realm of nature it is remarkable how exceedingly important certain elements are in comparison with others. Probably no single element plays a greater part in the soil economy than does calcium. The whole flora of a soil, its agricultural possibilities, and therefore the comfort and well-being of the agricultural community that dwells upon it, are all profoundly affected by the consideration whether it does or does not contain reactive calcium. A third great soil division depends on the fate of the organic matter; in the normal case it mingles with the soil, being drawn in by earthworms, ants, or other animals; but when mingling agencies are absent it lies on the surface and forms peat, fen, or muck soils."

The lecturer proceeds: "Time does not allow of consideration of the laterites, the peats, or the fen soils. We are concerned mainly with a great middle region . . . where the decomposition products have persisted so that colloidal substances are present; where there may or may not be much reactive calcium, but where there is invariably organic matter, the remains of older generations of plants, which have decomposed so far as to reach the steady state . . . Reference has already been made to the fact that some of the soil constituents are in the jelly-like or colloidal condition. The soil particles are pictured as being coated with jelly just as if they had been steeped in it. The study of the soil colloids is one of the triumphs of modern times, and is furnishing the explanation of many important soil properties which had previously been wholly inexplicable." The lecturer's scheme of soil classification is illustrated by a very interesting chart.

The book is well printed, and the illustrations are admirable, but the absence of an index is a distinct blemish.

B C A.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Journal* from 19th May to 30th June, 1927, include the following of agricultural interest:—

No. 56034: Farm-implement lifting-device, S. Upritchard, Arundel. No. 56645: Weed-destroyer, P. Allsop, Frankton Junction. No. 58211: Sheep-shearing-machine comb; F. G. W. Bristow, Sydney, N.S.W. No. 56595: Wool-pack; R. F. Smaile, Dunrobin. No. 58243: Milking-machine pulsator, D. F. and N. H. Watson, Waitoa. Nos. 55675 and 58390: Cattle-food, J. Jensen, Hamilton. No. 57663: Portable butter-collectors; J. O'Connell and H. H. Kerr, Kensington, Victoria. No. 57995: Sheep-shear hand-piece, G. F. Hight, Auckland. No. 58284: Correction of wind-sucking in horses; F. L. Eastgate, Christchurch. No. 56319: Cream-separator drive-pulley, W. Scott, Christchurch. No. 56458: Milk-pipe fitting; O. A. M. Randrup, Hamilton. No. 56734: Pasteurizer; Wilkins Ltd., Invercargill. No. 56959: Cheese vat tap; J. M. Collins, Hawera. No. 57486: Milk-testing appliance; G. S. Thomson, London. No. 57979: Plough-lift; B. McKay, Mayfield. No. 58504: Pasteurizer; E. D. Berry, Palmerston North.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office; or fees may be remitted by Post Office order or postal note.

Chilean Nitrate Organization.—The Chilean Nitrate Committee of Valparaiso and London advises that for reasons of economy it is closing several of its delegation offices, including that for Australia, New Zealand, and the South Sea Islands, with headquarters at Sydney. Supplies of nitrate of soda will be obtainable as usual, however

WEATHER RECORDS : JUNE, 1927.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE percentages of rainfall, compared with the means of former years, were heavier in the northern and east coast districts of both Islands, and, as usually happens when the balance falls on the eastern side, the western and southern districts experienced lighter rainfalls than usual. In Poverty Bay, Hawke's Bay, and parts of North Canterbury the falls were over 100 per cent. in excess of the average, and in these east coast districts were generally welcomed, for rainfall has been less than the usual for some time. On the west coast of the South Island the deficiency was from 20 to 70 per cent. below the mean for former years.

During the first week of the month anticyclonic conditions prevailed—bright days and cold nights. The barometer fell rapidly on the 6th and 7th, and was accompanied by strong north-easterly winds, which were severe, particularly in Otago. A westerly depression held sway during the following week, with very unsettled and cloudy weather, and about the 12th ended up with a smart southerly, which brought a wintry snap with falls of snow on the 11th, 12th, and 13th. The barometer continued high for three or four days, and then fell for two days. This depression ended with a severe south-easterly which prevailed, particularly in the northern and east coast districts, being accounted for by a cyclonic disturbance from the north encountering an anticyclone which held sway in the south. Unsettled weather followed until the end of the month, and some very severe frosts were recorded in Otago and Southland on the 19th, 20th, and 21st, being regarded as the hardest for over forty years. Frosts were recorded in Christchurch on twenty-two mornings, and many places inland in the North Island also recorded frosts on fourteen or fifteen mornings in the month. The Albert Park Observatory in Auckland recorded frosts there on the 14th, 15th, and 16th.

Temperatures were again below the mean for former years, and more so than in May. There was also very little wind, excepting from the three storms mentioned above. Although conditions were cold and changeable, they were, on the whole, fairly seasonable.

RAINFALL FOR JUNE, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
<i>North Island</i>				
	Inches.		Inches.	Inches.
Kaitiaki	6.12	15	1.58	5.53
Russell	6.65	12	3.00	6.90
Whangarei	8.01	15	2.17	5.51
Auckland	7.09	18	2.50	4.91
Hamilton	4.27	20	0.70	5.19
Kawhia	6.41	20	1.04	5.46
New Plymouth	6.35	16	1.46	6.20
Riversdale, Inglewood	6.60	17	1.38	10.31
Eltham	4.84	23	0.97	5.40
Whangamomona	4.49	18	1.05	7.02
Tairua	7.12	17	1.84	6.95
Tauranga	6.44	15	1.50	5.42
Maraekakaho Station, Opotiki	7.80	11	3.01	5.90
Gisborne	10.56	17	2.24	5.28
Taupo	7.40	10	1.60	4.35
Napier	8.00	18	2.10	3.59
Maraekakaho Station, Hastings	7.50	17	1.86	3.33
Taihape	3.85	18	0.87	3.85
Masterton	7.91	21	1.93	3.48
Patea	4.15	15	0.62	4.40
Wanganui	3.84	12	1.30	3.19
Foxton	3.60	12	1.04	2.96
Wellington	5.44	17	1.92	4.87

RAINFALL FOR JUNE, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average June Rainfall.
<i>South Island.</i>				
	Inches.		Inches.	Inches.
Westport	3·55	17	0·58	7·53
Greymouth	5·28	15	1·03	8·27
Hokitika	4·33	14	0·82	9·60
Ross	4·40	10	0·95	9·20
Arthur's Pass	3·01	6	0·96	10·12
Okuru, Westland	9·38	6	2·70	10·76
Collingwood	9·17	14	2·23	11·33
Nelson	3·00	12	0·83	3·69
Spring Creek, Blenheim	2·91	12	1·32	3·01
Tophouse	3·48	11	0·95	4·75
Hanmer Springs	3·32	14	0·96	3·05
Highfield, Waiau	3·28	11	0·86	2·49
Gore Bay	5·15	14	0·86	2·34
Christchurch	3·61	14	0·82	2·66
Timaru	2·62	10	0·92	1·70
Lambrook Station, Fairlie	1·68	2	1·34	1·91
Benmore Station, Clearburn	0·77	7	0·50	2·06
Oamaru	3·06	9	1·08	2·01
Queenstown	0·53	5	0·34	2·46
Clyde	0·50	3	0·33	0·08
Dunedin	2·61	10	1·35	3·15
Wendon	0·84	4	0·26	2·71
Gore	0·78	7	0·35	2·05
Invercargill	1·04	12	0·24	3·60
Puysegur Point	5·82	14	1·20	6·58

—D. C. Bates, Director.

INTERIM RETURN OF SHEEP AT 30th APRIL, 1927.

District.	Number of Sheep.		Difference
	Final Return, 1926.	Interim Return, 1927.	
Auckland	2,244,603	2,271,199	+ 26,596
Gisborne - Hawke's Bay	6,236,211	6,271,048	+ 34,837
Wellington - West Coast	5,349,436	5,340,603	- 8,833
North Island totals	13,830,250	13,882,850	+ 52,600
Marlborough-Nelson-Westland	1,353,075	1,345,424	- 7,651
Canterbury-Kaikoura	4,971,322	5,041,480	+ 70,167
Otago	4,750,346	5,102,611	+ 352,265
South Island totals	11,074,743	11,489,524	+ 414,781
Dominion totals	24,904,993	25,372,374	+ 467,381

Importation of Potatoes.—Regulations under the Orchard and Garden Diseases Act, governing the importation of potatoes into New Zealand, were published in a supplementary *Gazette* dated 5th July, and came into force on that date.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

LICE ON SHEEP.

"ANXIOUS TO LEARN," Owaka Valley :—

I should be glad of information regarding lice on sheep and lambs after they have been dipped in paste-dip or other dips, as I cannot get rid of lice at times. Some say that lice are in the paddocks after certain periods of breeding, and come on sheep at different stages of growth. I fail to know where the lice come from, as even tick-eggs are killed by the dip. The lambs are not in poor condition

The Live-stock Division :—

Non-poisonous dips are useless for lice. In a wet district like Catlins lice breed and thrive better than in a dry one. To keep sheep free from lice a poisonous dip should be used. Good sheep husbandry requires dipping the sheep off the shears with a non-poisonous dip, and again in autumn with a poisonous dip. This suffices to keep sheep clean. Lice-eggs are not killed by the dip. They take from six to ten days to hatch; but if the sheep are thoroughly dipped with a poisonous dip enough remains in the fleece to destroy the young lice when they hatch. Lice cannot live off the body of the sheep for many days. If you wish to be doubly sure that lice are destroyed a second dipping in fourteen days after the first could be done. If sheep are badly infested they will not thrive, but fat sheep can become lice-infested as easily as poor ones.

MANAGEMENT OF PASPALUM-DOMINANT PASTURES.

H. COX, Rawene, Hokianga :—

I should be obliged if you would advise me whether the burning-off of rank grass in the spring—say, August and September—would have an injurious effect on land which had been top-dressed with basic slag or superphosphate in the preceding autumn. The grass here is mainly paspalum, and there is too much green growth to burn in the autumn. I am now top-dressing with basic slag, and desire to burn all rank growth in the spring.

The Fields Division :—

Occasional burning off of rank paspalum in spring while the ground is still wet does little harm to this grass, which comes away fresh and green again. Continued burning, however, results in a marked delay in the recovery of the paspalum. This has been clearly demonstrated throughout the Hokianga district, where regular burning was practised to provide a fresh bite for the cows in spring. Where pastures have been top-dressed the effect of burning would be less marked, but it must be remembered that so long as paspalum is allowed to get rank enough to burn the clovers will be shaded out, and the result will be a pure paspalum association even with top-dressing. The experience of other farmers in your district is that with top-dressing and a consequent increase in stock, together with adequate subdivision, there is very little rank growth left to burn in spring, even where it is not possible to save hay or use the mower. The pastures that get away in the summer are used for wintering, and the rank growth is cleaned up. This will no doubt be your future experience also, providing you make the best use of the stock available in keeping some of the top-dressed pastures closely grazed during summer, and use the others either for hay or for wintering the stock. By alternately grazing in the summer one season and closing in the next for winter feed, the clovers can be more easily kept going, while the top-dressing can be depended on for the provision of fresh succulent feed in spring without recourse to burning and the loss of the clover in the pasture.

CATTLE-BREEDING AND GENETICS.

"BREEDER," Piopio :—

I have been breeding Polled Angus cattle for a few years, using pedigree bulls. Together with the Polled Angus cows I have a few well-bred Shorthorns. The progeny from the latter are either pure-black with now and then a little white round the udder, or from light roan to blue-grey. But on breeding from this progeny again (using purebred Polled Angus bulls) there is occasionally a calf with a white leg or legs, or a white star on the forehead. These would not be bred from, but I should like to know how many crosses it would take to entirely eliminate this feature. A crossbred Shorthorn-Hereford still shows a mottled face on the second cross. Is this according to the Mendelian theory—that is, characteristics coming out in the second cross and not in the first?

The Live-stock Division :—

Treating the matter on principles of modern genetics, we do not think that by using your purebred Polled Angus bulls on the progeny of Polled Angus and Shorthorn animals you will ever eliminate the reversion to a recessive colour appearing from time to time. You will probably find that in every four animals produced you will get three black and one that will not be pure-black (ratio 3-1). Black is the dominant colour, and the colours in the Shorthorn would be recessive to black; therefore they crop up only from time to time, and it must take many generations—if it is ever possible—to eliminate them entirely. Your purebred Polled Angus cattle will be what a genetist would term homozygous on both sides—that is, they produce nothing but pure-black stock, as they possess what are called determiners or factors, as well as hereditary characters in the fertilized egg, and these are expressed as development proceeds. The progeny you are breeding from now are what one would term heterozygous as far as coat-colour character is concerned, and from these, even if they are to all appearance pure-black (heterozygous black), there will appear from time to time an animal that shows patches of white. In the same way an occasional red calf crops up in an Angus herd, which can be accounted for if it can be shown that at some time during the formation period in the history of the herd a red individual was employed. In the case of the crossbred Shorthorn-Hereford showing the mottled face on the second cross, this is in accordance with the Mendelian theory.

STOCK SLAUGHTERED, 1926-27.

THE following are the numbers of stock slaughtered at abattoirs, meat-export works, bacon-factories, and ordinary registered slaughterhouses throughout the Dominion during the year ended 31st March, 1927 :—

Stock.	Abattoirs.	Meat-export Slaughterhouses.	Bacon- factories.	Ordinary Slaughterhouses.	Totals.
Cattle	157,771	163,268	..	83,946	404,985
Calves	42,695	57,791	..	2,472	102,958
Sheep	609,581	2,409,396	..	238,409	3,257,386
Lambs	126,944	5,343,766	..	23,701	5,494,411
Swine	136,544	201,766	41,267	23,143	402,720

—Live-stock Division.

Live-stock Statistics.—Interim returns show 3,241,630 total cattle (including dairy cows) in New Zealand at 31st January, 1927, as compared with 3,452,486 (final figures) at the same date in 1926. Dairy cows are returned at 1,295,447 head, as against 1,303,856 in 1926. Pigs show an increase from 472,534 to 516,204, and horses a decrease from 314,867 to 302,088.

The New Zealand Journal of Agriculture.

VOL. XXXV.

WELLINGTON, 20th AUGUST, 1927.

No. 2.

TEMPORARY STERILITY IN DAIRY COWS.

INVESTIGATIONS DURING SEASONS 1925-26 AND 1926-27.

W. M. WEBSTER, B.Sc., M.R.C.V.S., Veterinarian, Department of Agriculture,
Masterton

OF recent years dairy-farmers in New Zealand have met with increasing difficulty in getting their cows to hold to service at the desired time. It is becoming a common experience to find numbers of animals, and sometimes even entire herds, which return to the bull time after time, generally at about the normal period of three weeks, but eventually hold towards the autumn. In the following season these animals do not calve until November or December, when the first flush of the milking season is past. Others, again, fail to hold even towards autumn and are milked right through the winter, but almost invariably hold to their first service when put to the bull again in the following November. In either case the net result is a considerable monetary loss to the owner.

In an endeavour to arrive at a definite conclusion as to the causes of this disease, and to evolve, if possible, suitable preventive or curative measures, an extensive study of the whole problem has been undertaken among the dairy herds in the Wairarapa during the past two years.

SCOPE OF THE INQUIRY.

While the result is always the same—namely, a failure to conceive for a longer or shorter period—it was thought possible that there were a number of different factors, any of which, under varying conditions, might be responsible, and in consequence all possible avenues have been explored. Affected herds have been repeatedly visited, and data collected under various headings.

The history of the herd in previous years was obtained. Breed and general conditions were noted, and, whenever available, complete lists of the service dates of each animal were collected. The class of country and the quality of pasture on which affected herds grazed were studied. The method of farming was also taken into consideration, as regards the amount of top-dressing, if any, carried out, whether or not the bull was allowed to run with the herd, &c. Affected animals were thoroughly examined, their condition noted, and various methods of treatment tested. A given number were treated, while others were left as controls in each herd.

The reproductive organs of large numbers of cows going through the freezing-works were systematically examined and the findings tabulated. In this direction the cull-cow "drives" organized throughout the district by the Farmers' Union proved of great assistance. They afforded a large body of suitable material upon which to work, and, in addition, it was possible in many cases to examine individual cows and obtain their histories prior to slaughter, thus comparing ante- and post-mortem findings.

Finally, the possibility that failure to readily conceive was a sequel to some other known diseased condition of the reproductive organs—for example, contagious abortion, pustular vaginitis, &c.—was not lost sight of, and every endeavour was made to discover any existing relationship.

ANATOMICAL RELATIONSHIP, ETC.

Technical terms have been reduced to a minimum, but their total elimination in an article of this nature is impossible. Consequently

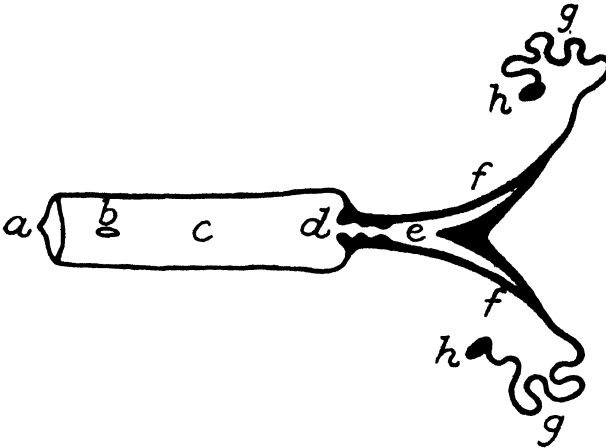


DIAGRAM OF REPRODUCTIVE ORGANS OF COW (FROM ABOVE).

(a) Vulva or bearing; (b) opening from bladder; (c) vagina or passage; (d) cervix or neck of womb; (e) uterus or womb; (ff) horns of uterus; (gg) oviducts; (hh) ovaries.

it is hoped that the accompanying diagrammatic representation of the reproductive organs of the cow will not only render the majority of such terms intelligible to the reader without further explanation, but also enable him to appreciate the relationship of the various parts of those organs.

POST-MORTEM EXAMINATIONS.

During the past two seasons the reproductive organs of 372 cull cows have been systematically examined at the freezing-works, and notes taken of the findings in every individual. In addition, material was collected, wherever possible, from abnormal cases and forwarded to the Department's Veterinary Laboratory at Wallaceville for further examination.

The animals examined consisted, roughly, of equal numbers of pregnant and empty cows. The great majority of the pregnant animals had been culled for reasons other than temporary sterility, although some had held to service only very late in the season; nevertheless their examination yielded most interesting results.

It would serve no useful purpose in an article such as this to describe the many minor and occasional abnormalities met. The one outstanding feature was the great frequency of cervicitis (inflammation of the cervix or "neck" of the womb). The approximate age of the calf in each cow at the time of slaughter was recorded, and the animals classified under the headings of (a) normal pregnancy, (b) pregnant with cervicitis.

Table 1.
Total number of pregnant animals, 199.

Date of Examination.	Normal Pregnancy.	Average Duration.	Pregnant with Cervicitis.	Average Duration.
31/5/1926	39	4.8 months	22	2.75 months.
6/4/1927	21	3.1 ..	5	2.3 ..
29 4/1927	12	4.1 ..	15	2.6 ..
31 5/1927	65	4.5 ..	20	2.9 ..

Reference to this table shows a striking difference between the average age of the calf where the mother's cervix is normal and the average age where it is in an inflamed condition (cervicitis). It must also be borne in mind that, no matter what other abnormality was present, an animal was classified as normally pregnant provided it showed no cervicitis.

As the date of slaughter has no bearing on the findings among the empty cows the results of the past two seasons may be considered as a whole. A total of 173 was examined, and, in contrast to the pregnant animals, these were slaughtered without exception for the sole reason that it had proved impossible to get them to hold to service. In tabular form the findings are as follows:—

Table 2.

Number.	Post-mortem Findings.					Percentage of Total.
114	Cervicitis with or without abnormal ovaries ..					65.9
76	Abnormal ovaries with or without cervicitis ..					43.9
56	Cervicitis plus abnormal ovaries					32.4
56	Cervicitis only	..	..	..	..	32.4
30	Normal	..	..	..	..	17.3
19	Abnormal ovaries only	..	..	..	..	10.9

On referring to the table it will be seen that two-thirds of all empty cows were suffering from cervicitis, and that half of these also showed diseased ovaries. On the other hand, only rather more than one-tenth showed diseased ovaries without an attendant cervicitis.

DEDUCTIONS FROM POST-MORTEM RESULTS.

(1) Cervicitis was present in 47.3 per cent. of all animals examined, irrespective of whether or not they were in calf.

(2) Cervicitis is the commonest cause of cows returning repeatedly to the bull. It does not totally inhibit conception, but affected animals have difficulty in holding, and as a rule only do so late in the season and after repeated attempts.

(3) When an animal holds to service despite cervicitis the latter tends to clear up spontaneously between the second and third months of pregnancy. This is shown by Table 1, in which it will be seen that the average duration of normal pregnancy increases approximately *pro rata* with the date of slaughter, whereas among those pregnancies accompanied by cervicitis it tends rather to remain constant.

(4) There appears to be some connection between cervicitis and ovarian disease, but the latter is, as a rule, secondary to the former (compare Table 2). Cervicitis occurred frequently both by itself and associated with abnormal ovaries, whereas the latter only were comparatively rare.

EXPERIMENTAL TREATMENT.

During the 1925-26 season investigation was confined to the post-mortem examinations. The results obtained led to the provisional adoption of the view that cervicitis was the chief cause of temporary sterility. Consequently it was decided to attempt treatment during the past season (1926-27), and, at the same time, confirm the cervicitis theory by further post-mortem work. The latter object was fulfilled, as has been already shown, and the results attending the former will now be dealt with.

In the course of experimental treatment during the past season 243 cows from eleven different herds were examined by means of the speculum. This is a long funnel-shaped instrument which is inserted into the vagina, and by means of which the observer is enabled to obtain a view of the upper part of the vagina and the cervix. The previous history of each cow, including, whenever obtainable, full service dates, was ascertained. Where speculum examination proved negative and in other doubtful cases (seventy-four in all) the uterus and ovaries were examined manually by way of the rectum (the hindmost part of the bowel), through the wall of which they are easily felt. This revealed a number of animals to be in calf (some only recently so) at the time of examination; others had diseased ovaries, septic endometritis (pus in the uterus), &c., which rendered them permanently sterile. This reduced the total to 186 visibly affected with cervicitis and returning to the bull at approximately three-weekly intervals.

In order to gauge accurately the effects of treatment it was necessary to leave a number untreated to serve as controls. Owners were sometimes persuaded with difficulty to adopt this course, but thirty-nine animals were left for this purpose.

Three medicinal agents were given a trial—namely, 10 per cent. Lugol's iodine solution, 2 per cent. iodine in glycerine, and 10 per cent. ichthylol in glycerine. The method adopted was to thoroughly swab the inflamed cervix with the selected agent, using a cotton-wool swab on the end of a rod and applied through the speculum. This swabbing was carried out three or four times at four-day intervals, and the condition of the animal noted on each occasion.

For ease in comparison three degrees were recognized—slight, moderate, and severe. At the conclusion of treatment the result was classified under one of four headings—O.K., improved, no change, worse. Frequently cervicitis is accompanied by a varying amount of catarrh of the vagina. Thus a typical case-history would read as follows :—

Service Dates.	First Examination. January 17.	Second Examination. January 21	Third Examination. January 25.	Fourth Examination. January 29.	Result.
Nov. 14; Dec. 23	Cervicitis severe	Cervicitis moderate	Cervicitis moderate	Cervicitis slight	Improved
Jan 13; Feb. 2	Catarrh moderate	Catarrh moderate	Catarrh slight	Catarrh slight	

Treatment was not an unqualified success. Of the three agents employed, 2 per cent. iodine in glycerine gave the best results, and 10 per cent. Lugol's iodine solution was the least satisfactory; but there was not a great deal between them. The results may be shown statistically thus :—

Table 3

Result.	Treated Cows	Controls
O.K.	36 = 24.6 per cent.	5 = 17.2 per cent.
Improved	44 = 30.1 ..	6 = 20.7 ..
No change	47 = 32.1 ..	16 = 55.1 ..
Worse	20 = 13.5 ..	2 = 6.6 ..
Totals	147	29

In one herd ten controls were not examined regularly with the treated cows, and are not included in the above table. Of the treated cows, 54.7 per cent. were either cured or improved, while 37.9 per cent. of the controls either cleared up or improved spontaneously.

Apart, however, from visible signs of improvement is the more important point of holding to service. One hundred and nine treated cows—full service dates of which until 31st March were available—were served altogether 317 times, an average of 2.9 services per cow; while thirty-six control cows took the bull 130 times, an average of 3.6 services per cow, to the same date.

From these figures it is evident that, while treatment has been attended by some small measure of success, a very much higher average of cures must be obtained before it can be said that an

entirely satisfactory method of coping with the disease has been evolved, and it is intended to carry out further experimental work in that direction during the coming season.

Possible Sources of the Trouble examined and discussed.

BACTERIAL ORIGIN.

It frequently happens that temporary sterility suddenly makes its appearance in the majority of a herd which has experienced no trouble in previous years. When a herd is affected there is also a tendency for the trouble to decrease and finally disappear in succeeding years. Again, the disease may be rife in one herd while those adjoining experience no trouble whatever.

These facts lend colour to the view that temporary sterility is a specific contagious disease which appears and runs its course through a herd. In an endeavour to substantiate this theory a large amount of material has been obtained, not only from affected organs from the freezing-works but also from the inflamed cervix in the living cow, and submitted to examination at the Wallaceville Laboratory. Hitherto no success has been attained in this direction; much of the material has proved to be absolutely sterile, while from other samples only various of the commoner bacteria, which may be found in many situations, have been isolated.

There is, of course, the possibility that the disease is due to what is known as a virus—that is, an infective organism which is so small that it passes through the finest bacteriological filter and is invisible under the most powerful microscope. However, in view of the apparent contagion in many instances, it is intended to continue the search for a possible causative organism next season.

THE BULL.

The possible bearing which the bull has upon this disease is a big problem, and, in many ways, one of the most difficult with which to deal. He does not admit of any close examination unless roped and thrown. The reproductive organs of twenty-three bulls were examined in connection with the cull-cow drives, but no abnormalities were discovered. A very limited amount of bacteriological work in the same direction also proved abortive.

Up to the present it has not been possible to prove that the bull does carry the infection from cow to cow, although there are some indications in that direction; on the other hand, cervicitis has been found in young heifers, and even in a calf six months old. However, there exists a strong possibility that the bull may play some such part, and irrigating the bull's sheath after every service is an ideal to be strongly impressed upon dairy-farmers. Past experience has shown that repeated douching has had little or no effect upon the cows; indeed, there is a suspicion that in some cases an excess of zeal in the matter of such douching has been productive of harm rather than good through setting up an irritable condition of the vagina.

The act of calving and cleansing afterwards is a perfectly natural physiological process at full time. Provided the cleansing comes away within five or six hours of calving and there is no abnormal discharge afterwards, there should be no necessity to douche the cow. In the case of abortion, a dead calf, retained membranes, or undue purulent discharge, disease is present, and suitable antiseptic douching

is then indicated. As already stated, even repeated douching has hitherto failed to effect a cure in affected cows, while no sign of disease has hitherto been disclosed in the bull. The male may thus be a mechanical carrier of the disease from cow to cow, in which case irrigation of the sheath after every service should go a long way towards limiting the extent of the trouble.

The bull should always be kept in a separate paddock, and cows be put to him as required; the practice of running the bull with the herd cannot be too strongly condemned. He is, as a rule, easily broken in to show little or no resentment to the irrigation. The writer has seen bulls which could be irrigated standing in the paddock. It is, however, important never to use any antiseptic solution which may cause smarting or burning, especially when first breaking the animal into the treatment. A weak solution of permanganate of potash (Condy's crystals) of port-wine colour is sufficient for the purpose.

CONTAGIOUS ABORTION.

Contagious abortion was thought to be a factor in causing temporary sterility, but, up to the present, investigation has failed to establish any connection between the two. Contagious abortion in some instances certainly does bring about a state of sterility, but it is of a permanent and not a temporary nature. The act of abortion is frequently followed by retention of the membranes, which are firmly adherent and have often to be left to gradually rot away. This sets up what is known as septic endometritis, in which small quantities of thick, clotted, foetid pus remain in the uterus for a long period extending sometimes over several years. This naturally precludes any possibility of the animal holding to service.

In the course of the post-mortem examinations recorded earlier endometritis was met with in only nine cases, six of which were associated with cervicitis and/or ovarian disease. Furthermore, as shown by individual histories which have been obtained, such cases are characterized by the extreme irregularity and short intervals at which the cow returns to the bull. Cows in herds under observation, in which contagious abortion was rife in the spring, had no difficulty in getting in calf again, save in odd instances such as described above. In addition it is possible by a simple laboratory test to determine whether any animal has been affected with contagious abortion, but examination at the Laboratory of numerous blood-samples taken from cows suffering from temporary sterility has failed to show any connection between the two diseases.

Granular Vaginitis.

This comparatively harmless condition was formerly viewed with suspicion, but all attempts to implicate it have proved negative. Probably over 50 per cent. of all cows are affected, and it is found equally in virgin heifers and aged cows. Further, routine examination has shown that very frequently the animals returning repeatedly to the bull show little or no sign of the complaint, while the worst-affected animals in the same herd have held successfully to the first service. In other instances the great majority of a herd the members of which have experienced no difficulty whatever in getting in calf are found affected.

Pustular Vaginitis.

This is a form of venereal disease in which the symptoms are extremely rapid in onset. Within twelve to twenty-four hours from the time of service affected animals show marked discomfort, standing blaring with arched back and distended tail. Urine is repeatedly passed in small quantities, and there is a purulent yellow discharge from the vulva. On examination the lining membrane of the vagina is seen to be intensely inflamed, and thickly studded with small white pustules and ulcers. The ulceration tends to spread, and may be so extensive that the greater part of the membrane is destroyed. In one herd, thirty-eight in number, under observation, eighteen animals went to the bull and were affected as described within twenty-four hours of service. Strict isolation of the affected animals and the use of a clean bull on the remaining twenty completely arrested the spread of the disease. Fifteen of the affected animals held to their service; the remaining three returned, but had not cleaned up at the time; however, they held successfully when put to the bull six weeks later. Under treatment the symptoms cleared up in about three weeks. A noteworthy point was that, although the whole of the vagina was acutely inflamed, the cervix remained clean and healthy-looking throughout.

Mineral Deficiency.

The possible bearing of this factor was borne in mind and extensively investigated. The condition known as "Waihi disease" occurs in several localities in the Wairarapa district, on poor land among the foothills of the ranges which is unsuited for dairying. It is characterized by general poverty, a sunken eye, harsh coat, chewing of bones and sticks, and rheumatism in the joints. Affected animals frequently feed kneeling and move with great stiffness, accompanied by audible clicking and creaking of the joints. Rapid improvement results from the provision of a suitable mineral lick or from feeding a little bran with the addition of bone-meal, superphosphate, &c., in suitable quantities. Five herds thus affected have been under observation. The worst, forty-five in number, was almost generally affected to such an extent that it took three-quarters of an hour morning and evening to drive the animals from bails to paddock, a distance of half a mile.

Another characteristic of this condition is a complete failure of some cows to come to season, yet every animal held successfully to the first service, though some of them did not come on for the first time until late in the season and in response to mineral feeding. In only one herd were there some six or eight cases of regular return to the bull showing typical cervicitis, in addition to a number of others which never came to season and in which the cervix was normal.

On the other hand, the majority of the worst-affected herds were grazing on first-class land, and were in two instances in fat condition. One herd, thirty-seven in number, all of which were still returning to the bull at the end of January, and eleven still empty at the end of the season, was without exception in fat condition, grazing on a first-class farm which had been systematically top-dressed for several years. Another large herd of 134, grazing on drained swamp which has never

been top-dressed, has forty cows still empty at the end of the season. Further similar instances could be quoted, but the foregoing seem to show that the available supply of phosphorus has little or no bearing on temporary sterility of the type described in the opening paragraph of this article. Investigators elsewhere have shown that a lack of sufficient available calcium or potassium in the ration has a direct bearing on reproduction.

There is another aspect of mineral deficiency in the soil which also remains open to investigation. It is a well-known fact that New Zealand soil as a whole is markedly deficient in iodine compared with most parts of the world. Recent research work, which is still proceeding, in parts of Canada and other countries where a similar iodine deficiency exists, has demonstrated that feeding minute daily doses of iodine has brought about not only a general bodily improvement of stock but also an increased breeding fertility. In view of these results there is a possibility that the addition of either or all of these minerals to the ration may be attended by beneficial results in this country, and experiments in this direction will be initiated during the coming season.

Acidity.

It has been recognized for a number of years that a very slight degree of acidity rapidly destroys the vitality of the spermatozoa (the living elements in the male fluid). The upper part of the vagina and cervix is normally slightly alkaline in reaction, but occasionally a slight degree of acidity is present. To neutralize this condition where it exists, douching with a solution of bicarbonate of potash a short time prior to service is practised with good results. In order to ascertain the frequency with which acidity occurs tests were made in some 150 cows. Only three gave an acid reaction, while seven were neutral; the remainder were normal—that is, slightly alkaline. In view of this, acidity may be dismissed as a minor factor in the problem.

CONCLUSION.

Much further work requires to be done before the problem of temporary sterility is satisfactorily solved, but the investigations up to the present seem to have considerably narrowed the scope of inquiry and given a clearer understanding of the problem. A number of factors formerly regarded with suspicion as having a possible bearing on the subject have been eliminated, and attempts at treatment have met with some slight measure of success, seemingly indicating at least that work is proceeding on the correct lines. Efforts towards the end in view will be continued during the coming season, including mineral feeding and a trial of other medicinal remedies, and it is confidently anticipated that a solution of the problem will eventually be reached.

The writer desires to express his thanks to Messrs. C. S. M. Hopkirk, B.V.Sc., and D. A. Gill, M.R.C.V.S., D.V.S.M., of the Wallaceville Veterinary Laboratory, who carried out all the detailed microscopic and bacteriological examination of pathological material, involving, as it did, a large amount of protracted and careful work. He is also indebted to Mr. J. Watson, Provincial Secretary of the Farmers' Union, for information concerning the various cull-cow drives.

NEW ZEALAND DAIRY-FARMING ECONOMICS.

SURVEY OF FARM GROUP IN PIAKO COUNTY, SEASON 1926-27.

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THE Fields Division of the Department of Agriculture has for some time past been engaged on an economic survey of the New Zealand dairying industry. The following article summarizing recent work on a group of thirty-five farms in Piako County is now presented, not for the purpose of drawing definite conclusions—since the number of farms dealt with is too small—but rather as an indication of the nature of the work and to show the necessity of its extension, so that the many variants enumerated may be “flattened out,” with the object of giving a true picture of average dairy-farming conditions.

PIAKO COUNTY.

Taking the official statistics for 1926, Piako County has a total area of 229,138 acres of occupied land, of which 194,102 acres are improved. Comprised in the latter class are 165,985 acres of sown pastures used exclusively for grazing, while some 22,000 acres are cut for hay or ensilage, or used for root or forage crops. Stock includes 53,741 dairy cows (23·454 per 100 acres), 44,475 sheep (19·410 per 100 acres), 33,195 other cattle (14·486 per 100 acres), and 5,058 horses (2·207 per 100 acres). In addition, there are 18,000 pigs—approximately 8 per 100 acres.

The county lies in an easterly direction from Hamilton, and is served by the Auckland Thames Railway. The chief town is Te Aroha, twenty-nine miles by rail from Hamilton.

Rainfall distribution is particularly favourable for pasture-maintenance, and to this factor the district largely owes its success in dairying. The rainfall for the year ended 30th June, 1927, was as follows :—

				Fall in Inches.	Number of Wet Days.
1926—	July	..	..	.. 5·94	8
	August	..	..	.. 6·92	19
	September	..	..	.. 2·79	12
	October	..	..	.. 8·63	23
	November	..	..	.. 6·20	23
	December	..	..	.. 5·66	11
1927—	January	..	..	.. 1·01	8
	February	..	..	.. 5·86	10
	March	..	..	.. 5·00	17
	April	..	..	.. 2·15	13
	May	..	..	.. 5·39	15
	June	..	..	.. 3·52	13
	Totals	..	..	.. 59·07	172

The particular locality to which this summary pertains is situated on the bank of the Waihou River, the largest number of farms being on the edge of the swamp area.

Table 1.—*Production and Costs per 100 Acres.*

1.	2.	3.	4.	5.			6.	7.				8.	9.	10.	11.	12.	13.	14.	
Sub-group Number.	Total Butter-fat produced.	Number of Cows milked.	Production per Cow.	Returns from			Fertilizer used for Top-dressing.	Expenses.				Maintenance Cost per Pound of Butterfat.	Interest, Labour, and Profit Capacity.	Capital Value (Land, Buildings, Stock, and Equipment).	Interest on No. 10 at 6% + 1% Sinking Fund.	Labour at £7 per Cow.	Profit.	Cost per Pound of Butterfat produced.	
				Pigs at 1s. 4d. per lb.	Cattle Account.	Account.		Manure	Repairs.	Sundry.	Power, Testing, and Rates.								Total.
1	17,235	57	317	1,196	16 1/2	1,272*	157	97	10	108	89	304	d 4-079	968	4,129	289	399	280	d. 13-3
2	15,443	51	309	1,029	95	1,117*	174	111	15	91	88	302	4-697	845	3,626	254	357	234	14-2
3	12,880	41	314	859	70	1,073	115	76	24	50	68	225	4-169	748	3,474	243	287	218	14-1
4	11,601	41	289	779	46	882	110	76	20	48	68	209	4-281	673	3,254	228	287	158	14-8
5	10,594	34	307	701	51	778	122	81	6	50	42	182	4-110	596	3,187	223	245	128	14-9
6	9,179	38	250	612	11	719	104	70	17	32	90	179	5-665	540	2,950	207	266	67	16-5
7	7,612	29	259	607	30	576	108	69	10	27	42	148	4-678	428	2,225	158	303	67	16-1
General average	12,220	42	291	815	59	1,007	127	83	15	50	61	221	4-164	685	3,264	230	291	162	14-6

* Owing to cattle losses in subgroups 1 and 2, the returns from butterfat, pigs, and cattle do not add up to the respective totals shown.

(See next page)

METHOD OF COLLECTING DATA.

The "survey" method was used—that is, each farmer was visited personally by a responsible officer, information being entered on a farm-survey form. Wherever possible, figures were checked from authentic records. So far as dairy farms are concerned, the winter months of June and July are most suitable for this work, as the season has just ended and data is therefore more likely to be correctly supplied than is the case at a later date.

AREA OF FARMS AND GENERAL DESCRIPTION.

The area of the farms in the group varies from 50 to 300 acres, the larger farms generally being situated on lighter country. The group is confined within a radius of approximately six miles. Area has a decided effect on production per acre, as indicated by Table 3.

Sixteen of the farms supply butter-factories, fourteen cheese-factories, and five dried-milk factories; share milkers are employed on nine of the farms; on six milking is done entirely by hand. The present owners have occupied thirteen of the farms for a period of less than nine years.

On the whole, pastures are in excellent condition. Approximately 50 per cent. of the farms provide winter feed in the form of swedes, such farms benefiting also from young grass sown after the root crop. Hay is saved in practically every case, the average area cut being approximately 14 acres. Several of the farms are too large for economic production, and in some cases paddocks need subdividing to allow stock-rotation on to fresh pasture growth. None of the farms is really overstocked.

Herds are maintained from picked calves, buying-in of cows being very rare.

PRODUCTION AND EXPENSES PER 100 ACRES.

For purposes of comparison all figures have been compensated to a 100-acre unit. It is not intended at this stage to discuss farms individually, but rather to show the averages for subgroups of farms, and then give a running commentary on the factors affecting them. Table 1 (see preceding page) shows the averages for subgroups of five farms each, classified from the highest to the lowest per-acre producers. The general average applies to the whole thirty-five farms.

PRODUCTION PER ACRE.

Up to a certain point the per-acre production is the most important economic factor in New Zealand dairy-farming. To what extent this figure can be raised without undue operation of the law of diminishing returns we do not at present know. The safe figure is apparently considerably above that reached by any farm within the group. The range of production is from 59.58 lb. to 206.47 lb. of butterfat per acre, with an average of 122.20 lb. The "frequency" of farms is more uniform below than above the average.

Table 2.—Distribution of Farms round the Average.

⁹⁰ / ₁₀₀	⁹⁰ / ₁₀₀		lb.	lb.		
61 to 70	above average equals	195.52 to 207.74	..	1	farm.	
51 "	60	183.30 "	195.52	..	1	"
41 "	50	171.08 "	183.30	..	0	"
31 "	40	158.86 "	171.08	..	6	"
21 "	30	146.64 "	158.86	..	1	"
11 "	20	134.42 "	146.64	..	1	"
0 "	10	122.20 "	134.42	..	5	"
0 "	10 below average equals	122.20 "	109.98	..	5	"
11 "	20	109.98 "	97.76	..	5	"
21 "	30	97.76 "	85.54	..	7	"
31 "	40	85.54 "	73.32	..	0	"
41 "	50	73.32 "	61.10	..	2	"
51 "	60	61.10 "	48.88	..	1	"

It is quite apparent that the factor of area of the farms has a decided influence on per-acre production. The study of even a small number illustrates this fact, as shown in the following table :—

Table 3.—Butterfat-production per Acre relative to Size of Farm.

Area	Number of Farms.	Cows milked per 100 Acres.	Butterfat produced per Acre.
Acres.			lb.
50 to 80	6	50	139.29
81 " 100	7	40	127.90
101 " 200	15	42	123.44
201 and over	7	35	99.18

This table also indicates the relatively higher carrying-capacity of smaller areas intensively farmed.

BUTTERFAT AVERAGE PER COW.

Production per cow is closely connected with per-acre production. With the exception of four herds, the first fifteen farms have an average of over 300 lb. per cow. The production figures have been determined on carrying-capacity rather than on herd-testing figures—that is, total production has been divided by the number of cows at the beginning of the season, irrespective of those thrown out after a few weeks' lactation. The average figure for the thirty-five farms corresponds with the factory average over the whole locality. The average per cow equals 291 lb. for the season.

Table 4.—"Spread" of Herd Averages.

⁹⁰ / ₁₀₀	⁹⁰ / ₁₀₀		lb.	lb.		
31 to 40	above average equals	378 to 407	..	1	farm.	
21 "	30	349 "	378	..	3	"
11 "	20	320 "	349	..	2	"
0 "	10	291 "	320	..	10	"
0 "	10 below average equals	291 "	261	..	11	"
11 "	20	261 "	232	..	5	"
21 "	30	232 "	203	..	3	"

PIG ACCOUNT.

On nine of the farms pigs are not kept. Most of the pigs are sold as weaners. The average return from this source is low, being

approximately £1 3s. 11d. per cow over all the farms. The highest return of any individual farm is £3 17s. per cow. There are 118 sows on the thirty-five farms, or one sow per eighteen cows. Each sow reared 10·5 pigs for the season. The death-rate among pigs in this district appears to be approximately 25 per cent.

CATTLE ACCOUNT.

As previously stated, the herds in this district are chiefly maintained from home-reared heifers. The average cow-replacement is approximately 17 per cent. on the farms under consideration. It is generally argued that, owing to this high annual renewal, depreciation should show as an expense in the accounts of a dairy-farmer. If all replacements were made by purchase of springing heifers or cows a loss would undoubtedly result, as cows must be charged in the account at a standard value. But where calves are reared, and eventually go into the milking-herd, an appreciating value must be put on them until they are absorbed. The Cattle Account will generally show a profit unless ill fortune has been experienced. The alternative method is to run two accounts—one for the milking-herd proper, and one which might be termed "Cattle-breeding Account." In this case the first account might show a loss, but the latter would show a profit.

All cattle on each farm have been incorporated in the one account. Standard values of £10 per cow, £5 per yearling, and £20 per bull have been used throughout. On six farms the Cattle Account showed a loss, but the average profit was £42 per 100 acres, or £1 per cow. When losses are made the amount is included in sundry expenses and considered as an incidence in the cost of production.

GROSS RETURNS.

In computing the gross returns from farms the value of butterfat had to be estimated, as bonus payments have not yet been made. The figure used is 1s. 4d. per pound, which, in the opinion of competent authority, is likely to be very near the final figure realized for the season of 1926-27. Gross returns per acre are influenced considerably by the Pig and Cattle Accounts. The average is £9·07, or £21·57 per cow.

Table 5—"Spread" of Gross Per-acre Earning-capacity of Farms.

%	%		£	£		
51	to 60	above average equals	13·60	to 14·50	..	1 farm.
41	" 50	"	12·69	" 13·60	..	1 "
31	" 40	"	11·79	" 12·69	..	5 "
21	" 30	"	10·88	" 11·79	..	2 "
11	" 20	"	9·97	" 10·88	..	2 "
0	" 10	"	9·07	" 9·97	..	4 "
0	" 10	below average equals	9·07	" 8·16	..	7 "
11	" 20	"	8·16	" 7·25	..	5 "
21	" 30	"	7·25	" 6·34	..	5 "
31	" 40	"	6·34	" 5·44	..	2 "
41	" 50	"	5·44	" 4·53	..	0 "
51	" 60	"	4·53	" 3·62	..	1 "

FERTILIZERS FOR TOP-DRESSING.

It is being generally appreciated by dairy-farmers that high per-acre production depends finally on grass-renovation. High-producing strains of cows are very important, but a high-producing cow quickly becomes a low-producer if not adequately nourished. It is at the present time more profitable to renovate grass pastures by the liberal use of phosphatic fertilizers than by the use of the plough, though the plough may in the first instance be necessary to procure the foundation on which to work.

In this group of farms twelve top-dress 100 per cent. of their land, and the average is 89 per cent., with fertilizers amounting to 12·7 tons per 100 acres. The smaller farms are manured more heavily than are the larger. The data at present to hand are not sufficient to permit of a definite comparison of effect of heavy top-dressing, but this will be made at a later date.

Table 6.—"Spread" of Manure used, in Tons per 100 Acres.

%	%		Tons.	Tons.		
61	to 70	above average equals	20·32	to 21·49	..	3 farms
51	.. 60	"	19·05	.. 20·32	..	1 "
41	.. 50	"	17·77	.. 19·05	..	1 "
31	.. 40	"	16·78	.. 17·77	..	0 "
21	.. 30	"	15·24	.. 16·78	..	5 "
11	.. 20	"	13·97	.. 15·24	..	3 "
0	.. 10	"	12·70	.. 13·97	..	3 "
0	.. 10	below average equals	12·70	.. 11·43	..	2 "
11	.. 20	"	11·43	.. 10·16	..	7 "
21	.. 30	"	10·16	.. 8·89	..	4 "
31	.. 40	"	8·89	.. 7·62	..	2 "
41	.. 50	"	7·62	.. 6·35	..	3 "
51	.. 60	"	6·35	.. 5·08	..	1 "

MAINTENANCE COSTS.

Maintenance includes all expenditure other than for labour, interest, or land-tax. It is here that great variation is found, resulting in a wide range of production costs. Depreciation on plant and buildings at the rate of 5 per cent. and 3 per cent. respectively is included. Herd-testing and electric power are included at standard rates on those farms concerned. The average maintenance cost per acre is £2·21, or £5 5s. 3d. per cow.

Table 7. Showing "Spread" of Maintenance Costs per Acre.

%	%		£	£		
71	to 80	above average equals	3·75	to 3·97	..	1 farm.
61	.. 70	"	3·53	.. 3·75	..	1 "
51	.. 60	"	3·31	.. 3·53	..	1 "
41	.. 50	"	3·09	.. 3·31	..	2 "
31	.. 40	"	2·87	.. 3·09	..	1 "
21	.. 30	"	2·65	.. 2·87	..	1 "
11	.. 20	"	2·43	.. 2·65	..	7 "
0	.. 10	"	2·21	.. 2·43	..	3 "
0	.. 10	below average equals	2·21	.. 1·98	..	3 "
11	.. 20	"	1·98	.. 1·76	..	6 "
21	.. 30	"	1·76	.. 1·54	..	2 "
31	.. 40	"	1·54	.. 1·32	..	3 "
41	.. 50	"	1·32	.. 1·10	..	1 "
51	.. 60	"	1·10	.. 0·88	..	1 "
61	.. 70	"	0·88	.. 0·66	..	2 "

Although the range as shown in the table is wide, it varies very much in accordance with per-acre production. From a study of Table 1 it will be seen that the group averages of five farms give a fairly consistent maintenance cost per pound. Expenses increase with a higher per-acre production, but increased production more than compensates for such an advance. With more data it is hoped that standards of maintenance costs will be established for different classes of farms, so that there may be available "efficiency standards" against which to check any farm coming under review.

INTEREST AND LABOUR CAPACITY.

The value of land depends upon its capacity, after maintenance expenses are met, for the earning of interest and the reward of labour, whether interest be payable on borrowed money or on personal capital, and whether labour be paid or be that of the owner. It will be noticed that the average amount left for these purposes is £685 per 100 acres, and that it decreases from £968 on the five highest farms to £428 on the five lowest.

The capital value of the land (Government valuation) is lower on the lower-producing farms, and therefore the total interest is less. So also is the value of plant, machinery, and stock. The fact that these poorer farms carry less cows per 100 acres means a lower labour bill for milking, but increased labour on maintenance. Despite these factors the final cost of production is less on the high-production farms.

From this stage consideration of the figures presents difficulties. On some farms no wages are paid; others pay nominal wages, most of the work being done by the owner; while others, again, employ share milkers who take one-third of the gross proceeds in lieu of wages. The same difficulty arises with regard to interest paid on mortgages. A proportion of the farms are unencumbered or practically so.

In order to overcome these irregularities it became necessary to standardize interest and labour. The capital value has therefore been taken, and to this is added the value of stock and equipment, charging the whole at the rate of 6 per cent. plus 1 per cent. sinking fund. It is recognized that this is not in every case the true value of the farm, but in the absence of a Land and Improvements Account it is the most uniform basis on which to work. Subgroups will be seen to vary from £4,129 to £2,225, with a general average of £3,264, of which £758 is stock and equipment. At 7 per cent. this represents an average annual interest cost of £229, or £5 9s. per cow.

After deducting interest from the amount representing interest and labour the remainder can, if it is wished, be considered as the labour earning capacity of the farm, but this would give an entirely wrong impression when interpreted in cost of production of butterfat. It has therefore been decided to charge all cows with £7 for wages. Thus if one man milks twenty-five cows his herd is charged with £175 for labour. This is purely an arbitrary assessment, but corresponds very closely with the per cow earnings of share milkers.

Table 9.—Showing Variations of "Spread" per 100 Acres in each Factor.

(Figures pertaining to No. 3 Farm printed in heavy type to show system of indicating individual farms.)

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
Total Butterfat.	Number of Cows milked.	Butterfat per Cow.	Butterfat at 18 4d. per Pound.	Returns from Pigs.	Cattle Account.	Total Returns.	Mares.			Repairs.	Sundry Expenses.	Power Testing, and Rais.	Total of Columns 10 to 13.	Wages, Interest, and Profit.	Government Value of Land + Stock and Plant.	Interest on Capital Value at 6% + 1% Sinking Fund.	Wages at 17 per Cow.	Profit.	Cost of producing Butterfat per Pound.
							Quantity.	Area top-dressed.	Cost.										
lb.		lb.	£	£	£	£	Tons.	Acres.	£	£	£	£	£	£	£	£	£	£	d
..	..	..	..	..	..	..	..	..	..	..	..	112	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	100	..	..	..	92	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	100	..	..	..	91	..	..	..	..	..	..	19-0
..	..	..	..	..	..	..	..	100	131	..	..	90	..	..	..	..	..	453	18-3
..	..	..	..	..	168	..	..	100	128	..	..	89	385	1,044	4,758	333	..	395	18-0
..	..	400	..	200	104	..	21-5	100	124	..	..	89	360	1,027	4,070	327	..	301	17-3
20,647	63	375	1,376	150	91	1,412	21-3	100	121	..	..	88	386	904	4,450	312	441	339	16-4
10,500	62	366	1,300	114	89	1,300	21-0	100	112	53	..	86	328	993	4,423	310	434	310	16-4
16,000	61	350	1,107	112	86	1,209	20-2	100	108	38	..	81	319	903	4,212	295	427	294	16-4
10,476	60	345	1,098	103	84	1,256	18-4	100	107	37	..	80	302	886	4,192	294	420	277	16-1
16,452	54	338	1,097	102	63	1,255	16-3	100	106	35	152	80	281	814	4,145	290	378	264	16-1
16,143	52	320	1,076	98	63	1,189	16-0	100	100	34	140	74	262	820	4,105	287	364	263	16-0
16,130	51	319	1,070	90	57	1,188	15-4	100	98	34	141	73	262	814	4,014	281	357	248	16-0
16,000	47	317	1,067	81	57	1,133	15-3	99	96	27	141	71	262	785	3,740	262	329	228	15-4
14,831	46	312	989	81	55	1,125	15-3	98	92	24	130	71	261	799	3,683	258	322	220	15-4
14,111	45	310	941	72	55	1,077	16-0	98	92	24	116	70	256	752	3,653	256	315	216	15-1
13,408	45	307	894	69	54	1,025	14-6	94	91	23	86	69	256	749	3,500	245	315	187	15-1
12,933	44	305	862	69	46	987	14-1	93	90	21	83	67	247	748	3,481	244	308	182	15-0
12,829	44	305	855	66	45	947	13-8	93	89	20	80	66	242	714	3,432	240	308	179	15-0
12,768	44	300	851	55	44	935	13-1	93	88	20	72	65	239	707	3,430	240	308	174	16-0
12,461	43	295	831	53	43	918	13-1	92	84	16	66	65	228	704	3,353	235	301	174	14-6
Average																			
12,220	42	291	815	50	42	907	12-7	89	83	15	59	64	221	685	3,264	230	294	162	14-6
12,150	41	288	810	43	36	901	12-5	87	80	14	57	60	220	674	3,250	228	287	146	14-6
11,790	40	285	786	39	34	889	12-4	86	77	13	56	60	211	667	3,096	217	280	145	14-2
11,714	40	282	781	33	34	862	11-4	86	75	12	54	55	208	657	3,052	214	280	126	14-0
11,600	40	281	773	28	31	855	11-3	83	74	10	51	53	195	644	2,988	209	280	107	14-0
11,200	38	279	747	26	23	848	10-9	81	73	10	49	48	193	643	2,905	208	266	84	13-6
10,946	38	279	730	22	19	837	10-9	80	72	9	48	47	188	642	2,935	205	266	77	13-1
10,809	38	268	721	18	15	831	10-8	80	69	9	46	45	188	620	2,879	202	266	68	12-4
10,345	37	267	690	17	14	777	10-5	79	65	9	44	43	187	521	2,857	200	256	59	12-4
10,313	37	266	688	10	13	756	10-3	79	62	9	43	40	182	508	2,684	188	250	57	12-4
10,105	36	264	674	8	5	747	10-0	78	60	7	43	37	164	505	2,625	184	252	45	12-1
9,751	36	264	650	Nil	4	744	10-0	73	57	7	42	33	161	503	2,573	180	252	35	12-2
9,536	35	258	636	Nil	-7	729	9-6	63	54	6	40	28	150	497	2,559	179	245	28	11-5
9,500	34	258	633	Nil	-12	724	9-4	60	48	6	37	20	138	494	2,552	179	238	27	11-4
9,375	31	255	625	Nil	-17	703	8-0	40	46	Nil	33	17	135	492	2,300	171	217	6	11-4
9,231	30	249	616	Nil	-23	664	7-9	..	45	Nil	31	..	130	477	2,220	155	210	-2	11-0
9,130	30	247	609	Nil	-24	641	6-7	..	43	Nil	28	..	103	440	2,050	144	210	31	..
9,099	27	227	607	Nil	-104	638	6-5	..	43	Nil	26	..	85	361	1,824	129	189	-70	..
7,055	27	221	470	Nil	..	578	6-4	..	..	Nil	25	..	80	359	1,572	111	189	..	..
6,818	25	217	455	Nil	..	554	6-0	..	..	Nil	24	..	..	..	..	..	175	..	..
5,958	..	..	397	..	..	444	..	..	..	Nil	20	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	Nil	18	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	11	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	6	..	..	..	..	..	..	..	..

PROFIT.

After deducting interest at 7 per cent. and wages at £7 per cow from the interest and labour earning-capacity of the thirty-five farms, a surplus is in most cases left, which varies from £280 per 100 acres on the highest group to £64 on the lowest, with a uniform drop throughout.

The returns indicated in the Cattle Account are not all handled as cash.

COST OF PRODUCTION.

If these figures are considered as relatively correct, it is then possible to compute the cost of producing 1 lb. of butterfat. The average cost for subgroups varies from 13·3d. to 16·5d., with a general average of 14·6d. per pound.

Table 8.—"Spread" of Production Costs per Pound of Butterfat.

%	%		d.	d.		
31	to 40	above average equals	10·90	to 20·44	..	1 farm.
21	" 30	"	17·52	" 18·98	..	3 "
11	" 20	"	16·06	" 17·52	..	6 "
0	" 10	"	14·60	" 16·06	..	11 "
0	" 10	below average equals	14·60	" 13·14	..	4 "
11	" 20	"	13·14	" 11·68	..	8 "
21	" 30	"	11·68	" 10·22	..	2 "

GENERAL.

It is admitted that the figures submitted may be inaccurate in certain details. In the original collection of data it is very easy for a farmer to forget certain items or to overestimate others, and the number of farms dealt with are not sufficient to equalize matters. The summary, however, is an attempt to show the true position as it pertains to these farms.

Apart from such original shortcomings, other items which might be questioned are (a) value of butterfat, (b) Cattle Account, (c) capital valuation, (d) rate of interest, and (e) labour charges.

As the figures stand, the final balance of £162 is accounted for mainly by the Pig and Cattle Account. A percentage of the profit shown in the latter is, of course, never handled in the form of cash. If pigs are regarded as a by-product of the dairy industry their importance in the final issue is very great. In this survey they represent 30·9 per cent. of the profit; Cattle Account, 25·9 per cent.; and butterfat, 43·2 per cent.—butterfat having borne all costs of production.

These farms show, on the whole, a very satisfactory position, but it must be remembered that their production is considerably above the average. A drop of 24 lb. per acre would put the group in an uneconomic position.

THE INSTRUCTIONAL ASPECT.

It is hoped that results of these group investigations may have a direct instructional value for the farmers concerned, in addition to providing data on which departmental instruction may be founded.

To this end each farmer who has supplied information will, when the group of which he is a member has been analysed, be supplied with a chart as depicted in Table 9. It will be noticed that the general average for all items in this table occupies the central line, with figures relative to each factor arranged from highest to lowest across the general average. On the chart to be supplied individual farmers the figures in each column pertaining to their own farms will be underlined. A specimen is indicated by heavy type in the printed table. The identity of the other farmers is completely hidden owing to a standard area being used, and also owing to the fact that in no case do the particulars of any farm run straight across the sheet. Each farmer will therefore be able to compare his own position with the remainder of the group and with the average of the whole thirty-five farms. If he is at all interested it will rest with himself to decide if he can in any way improve his position. A key to each chart will be kept in the Wellington office in case of correspondence on any point.

It is hoped that eventually farm types will subject themselves to a classification system. Standards will then be set up for each group, which will act as guides and comparisons for farmers, prospective farmers, and agricultural instructors generally. The first essential in such a task is possession of the survey data from a large number of farms, so that types may be picked out and placed in their respective groups.

CONCLUSION.

As previously stated, the present data are published as an indication of the work being done by the Department of Agriculture, in the hope that this will influence farmers generally to co-operate in the supply of information. It will have been demonstrated that the individual is entirely hidden, and thus result in greater confidence. It is expected to have data from some 150 Waikato farmers within the next few weeks, when further detailed tabulations will be made.

No attempt has been made to assess the rental value of the farmer's dwellinghouse, but it should be recognized that the house and farm perquisites are real assets, and must eventually be dealt with if a true statement of the position is to be made.

I wish at this stage to express my appreciation of the manner in which Mr. C. M. Hume, of Hamilton, has co-operated with the Department in this work. His advice and knowledge of the district have been freely given at all times. Thanks are also especially due to those farmers who have supplied the data making this survey possible. The field-work in connection with the group was done by Mr. I. W. Weston, M.Sc., of the Department of Agriculture

Average Weights of Lamb and Mutton.—According to the Meat Board, the average dressed weights at the meat-export works for the freezing season of 1926-27 were as follows (corresponding figures for 1925-26 being added in parentheses): Lambs, 34.8 lb. (34.3); wethers, 55.9 lb. (54.6); ewes, 54.6 lb. (54.1).

MANURIAL TOP-DRESSING OF HILL GRASSLAND IN MARLBOROUGH.

SOME RECENT EXPERIMENTAL WORK.

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HILL top-dressing experiments have now been in progress in the Marlborough District for two years. Work has been carried out on three distinct types of country.

(1) The hill country of the Upper Wairau Valley, at Hillersden and at Wantwood: This country, although comparatively poor, is clean, owing to the relatively dry climate and mainly sunny aspect. The vegetation varies as the altitude increases. At Hillersden and Wantwood, where the flat land is about 1,000 ft. above sea-level and the hill land from 1,500 ft. to 1,700 ft., the country is covered mainly by *Danthonia pilosa*, brown-top (*Agrostis tenuis*), hair-grass (*Aira flexuosa*), Yorkshire fog in the gullies, and brown-tussock. Bracken fern and manuka appear on the shadier and damper faces, but are easily cleared and kept under control. As one goes farther up the valley the proportion of tussock increases, native wheat (*Triticum scabrum*) and New Zealand rice-grass (*Microloena stipoides*) are found more abundantly, while brown-top and *Danthonia pilosa*, as well as *Danthonia semiannularis*, are still to be found, but in lower proportions. The main difference is seen in the lower palatability of the pastures, the more sparsely covered bottom, and the slower growth in spring.

Hillersden hill country has many characteristics in common with parts of North Canterbury. There are, however, essential differences: the winters are milder and shorter, hence the wintering of sheep does not present the same problem; the rainfall is heavier and fairly well distributed, excepting that the summers tend to be dry. Although the rainfall is good, the north-westerly wind, as in Canterbury, blows with great frequency and so renders the ground drier than it would otherwise be.

(2) The Sounds hill country: Here the climate is wet and mild, and winter conditions hardly exist. In addition to *Danthonia* and brown-top, such grasses as *Paspalum* are essentially of importance in Sounds pasture management. Naturally, under such conditions second growth, as represented by water-fern, bracken, tauhinu, and manuka, presents a serious problem. Such country, of the original "rain forest" type, resembles in many particulars some of the wetter and milder portions of the North Island, but, being in such close proximity to the sea, is on the sunny faces as warm in winter as parts of Auckland Province.

(3) The good limestone and papa country of the east coast, at Kekerangu: On this country English grasses, clovers, and some lucerne have persisted for twenty years without the application of artificial fertilizers. English grasses are now beginning to run out. An approximate analysis of the pasture at Ngaio Downs, Kekerangu, made at the end of July, gave the following percentages: *Danthonia*

pilosa, 50 ; cocksfoot, 15 ; perennial rye-grass, 18 ; *Chewings fescue*, 2 ; Yorkshire fog, 2 ; white clover, 3 ; tussock (*Poa caespitosa*), brown-top, Scotch thistles, horehound, and other weeds, 4 ; *Poa pratensis*, 3 ; lucerne, 1 ; yellow suckling-clover, 2.

The climatic conditions of the east coast may be described as mild and dry. Many parts of the front country experience only very light frost, while the frosts, of course, become more severe as one recedes from the coast. The driest period of the year may be set down as from December to April inclusive. English grasses on this country, in spite of the fact that a judicious system of fencing and stocking with cattle has been adopted, are now beginning to run out, and unless top-dressing becomes general it is probable that a complete reversion to danthonia and the lower-fertility-demanding types of grasses and weeds is imminent.

HILLERSDEN DISTRICT EXPERIMENTS.

In June, 1925, hill top-dressing experiments in the Hillersden district were commenced on the farms of Mr. R. Rentoul and Mr. W. McAlpine respectively, the latter property being taken over at the end of the winter of 1926 by Messrs. Fahey and Dunphy. In 1926 trials were also started on the property of Mr. F. L. Murray in the same district.

In the Hillersden district some store cattle are kept, but owing to the fencing difficulty and the relatively clean nature of the country the hills mainly carry sheep. This country may be classed as fair Merino country, and varies in winter carrying-capacity from half to three-quarters of a ewe per acre. The spring and summer of the 1925-26 season were extremely dry in this district. However, Mr. McAlpine reports that in the spring succeeding the first application of manure his carrying-capacity on this block increased practically 100 per cent. He also noticed the persistence with which sheep grazed on the manured blocks in preference to the unmanured areas. The scheme adopted was that of manuring acre blocks, with narrow unmanured blocks in between the areas top-dressed.

A similar arrangement was adopted on the other properties at Hillersden. In the first season the blocks ran as follows :—

- (1) Superphosphate, 2 cwt. per acre.
- (2) Check strip.
- (3) Mixture of 1 cwt. super and 1 cwt. ground Nauru phosphate per acre.
- (4) Check strip.

This series of plots was repeated three times, so that 6 acres were top-dressed in 1925 on each property.

In the 1926-27 season these areas were not top-dressed again, but the land top-dressed was extended, the reason for this being the consideration that it is unlikely that a farmer holding, say, 1,400 to 2,000 acres will be able to undertake the annual top-dressing of the same area of hill country. It is true that some farmers when they obtain good results in one hill paddock may top-dress that particular paddock annually to the exclusion of others. In the case of the Hillersden areas, however, the work has been carried out on the assumption that the farmer will naturally treat certain of his paddocks in rotation.

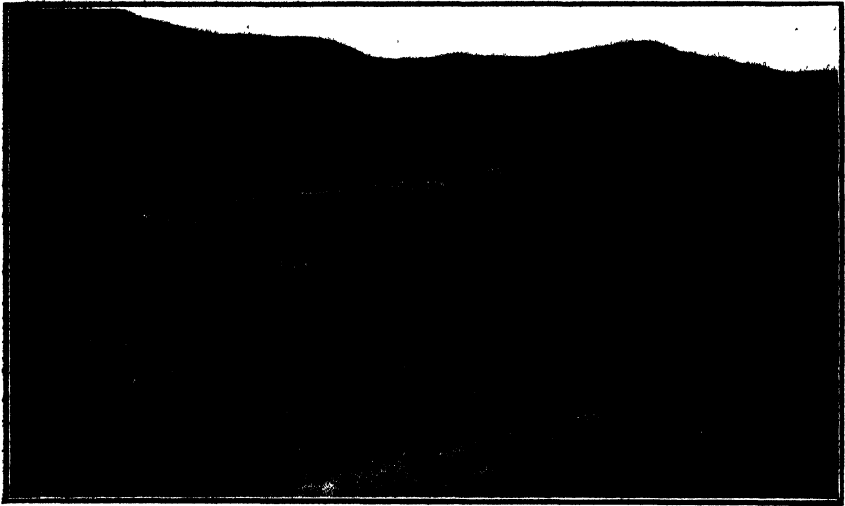


FIG. 1. GRASSLAND ON FAHEY AND DUNPHY'S FARM, HILLERSDEN

This top-dressed area (in middle distance) had been shut up for some time when photo taken, and plainly showed much heavier growth on manured plots running down side of slope.



FIG. 2. PART OF TOP-DRESSED AREA ON R. RENTOU'S FARM, HILLERSDEN.

Showing plot in foreground top-dressed with super in winter of 1925 closely grazed, with grass in adjoining unmanured control plot neglected by stock.

[Photos by the Writer.]

In the late summer of 1926, at the foot of Mr. McAlpine's hills, the abundance of droppings from sheep on the manured plots as distinct from the paucity of droppings on the untreated strips was very noticeable. At first it appeared that better results were being obtained from the mixture of Nauru phosphate and super than from the super alone. The knowledge that the Hillersden country is very deficient in lime might lead one to suppose that better results could be obtained from a basic type of manure. The slight distinction which appeared at first, however, has now entirely vanished, the super plots being as good and in some cases better than those treated with the mixture.

Messrs. Fahey and Dunphy report very favourably on the results of the 1926 winter dressing, but they are too new on the place as yet to give figures regarding increase in carrying-capacity. During the autumn and the winter of 1927, however, the block has been shut up. The accompanying photograph (Fig. 1) of a sunny face, taken last May, shows how rankly the tussocks, danthonia, and other grasses have grown on the manured plots compared with the check strips. When such defined strips can be seen in the early winter the evidence in favour of top-dressing is indeed strong. A farmer on the wetter hill country of the North Island would probably take this as a matter of course. It may be pointed out, however, that in dry seasons in this district manures often act with exceptional tardiness. Even on fairly heavy flat country the writer has known the results not to show until eighteen months after the application of the manure. The dry spell which succeeded the application of the fertilizers in the present case was, of course, an exceptionally bad one.

Results on Mr. Rentoul's property have been much slower in showing themselves. The reason for this is not at present apparent. In the 1925-26 season very little defined difference from the manure was to be seen, either in pasture-composition or in the tendency of the stock to graze one plot with more avidity than another. At the end of the 1926-27 season, however, most pronounced and interesting differences were noted. Fig. 2 shows how closely the plot which was treated with 2 cwt. super per acre in 1925 has been grazed, while the rank brown-top and danthonia heads on the adjoining check plot are left untouched. This paddock has not been shut up, but rather has been fairly continuously stocked. It would appear that a period of about eighteen months has been necessary before the effects of top-dressing became distinctly discernible to the eye. Now, however, the results appear to be very satisfactory. All manured plots are beginning to show distinctions both in pasture-composition and in the preference shown for them by stock. If there is any difference at all on this area between the kinds of manure applied it is in favour of super rather than the super and Nauru-phosphate mixture. Mr. Rentoul estimates an approximate increase of one-third in carrying-capacity this past season. It is remarkable that plots on which manure was applied last winter (1926) have not been grazed so closely as those top-dressed in the winter of 1925.

Mr. Murray, who top-dressed a hill block in 1926, reports no difference as yet.

TRIALS IN THE SOUNDS.

The Sounds trials have now been in progress for one season. Owing to pressure of work, top-dressing operations were not carried out last winter until early August. Three areas were selected: (1) at Onapua, Tory Channel (Fig. 3); (2) Portage, Kenepuru Sound; (3) Hopai, Pelorus Sound. In all three cases the pasture of the blocks dealt with consisted mainly of danthonia and brown-top, tending to run out to moss and bracken fern. At Onapua the amount of second growth is more considerable than on the other areas. The slopes dealt with include both sunny and shady faces, but are in the main sunny. (This winter, work with the shady faces more particularly is being started at Yncyca Bay.) The area of land employed at Tory Channel is between 15 and 16 acres, at Portage 12 acres, and at Hopai 8 acres. Five fertilizer treatments have been under test.

- (1) 3 cwt. superphosphate per acre.
- (2) 3 cwt. ground Nauru phosphate per acre.
- (3) $1\frac{1}{2}$ cwt. super and $1\frac{1}{2}$ cwt. ground Nauru phosphate per acre.
- (4) 3 cwt. Ephos phosphate per acre.
- (5) 3 cwt. basic slag (Belgian) per acre

Trials on each area were carried out in duplicate, with check plots interspersed.

Last New Year's Day a farmers' field-day was held at Hopai. All who saw the plots on that occasion expressed surprise at the quick response so evident in the case of certain manures. On this occasion the transformation in the plot treated with basic slag was unique, yellow suckling-trefoil and white clover, as well as rye-grass and cocksfoot, replacing bare spaces, weeds, and danthonia to a large extent. The plot treated with Ephos phosphate also showed excellent results, but it has been subsequently found that these results have not persisted as well even as those from superphosphate. An inspection made on 15th June last showed that even in midwinter the results from basic slag are still very evident. On that date the plot treated with Ephos had receded from its second position in order of merit; the plot now appears almost as depleted as the adjoining control plot. The effects from the use of super not only persist but show steady improvement. At Portage an inspection was last made on 14th June, the following observations being recorded:—

Superphosphate plot No. 1 very much cleaner than adjoining control plot. Moss has given place to perennial rye-grass, white clover, and danthonia. Adjoining control plot, partly situated in a gully, fair, but poorer than plot treated with super.

Plots treated with ground Nauru rock phosphate still fairly poor. Adjoining control plot also poor.

Plots treated with mixture of super and ground Nauru phosphate much brighter green. Thicker bottom than on adjoining control, on which the seed heads still remain uneaten.

Ephos plots fairly poor. Control plot situated between Ephos and slag plots shows distinct opening out of the pasture. Catsear and rib-grass showing to a marked extent.

Basic-slag plots very good. Big increase in clovers and English grasses. As yet, however, this area cannot be said to have shown results superior to those given by super.



FIG. 3. GENERAL VIEW OF TORY CHANNEL TOP-DRESSING AREA.

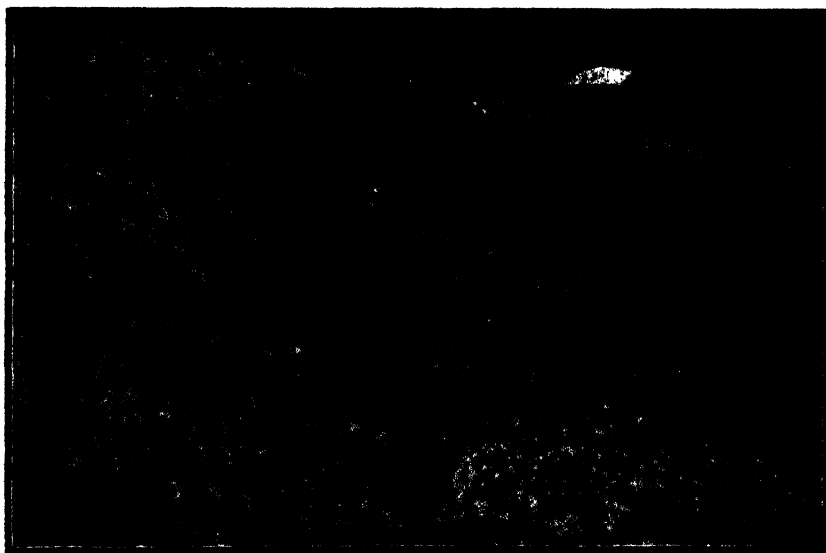


FIG. 4. PART OF TOP-DRESSED AREA ON A. H. DERRYSHIRE'S FARM, TORY CHANNEL.

Slope in middle view, treated with rock phosphate and super, grazed bare; long, ungrazed grass in foreground is on a control plot.

[Photos by the Writer.

By January practically all manures at Tory Channel were showing good results. It may be here mentioned that the Sounds country generally is very deficient in lime. Probably for this reason, also owing to the wet climate, basic manures seem to act very readily. At Onapua there was unmistakable evidence that on the wet, sour soil, ground Nauru phosphate, used alone, had brought back white clover, rye-grass, and yellow suckling-trefoil. On the ridges, however, results from this manure are practically negative, while superphosphate, both at Onapua and at Hopai, has evidently been instrumental in bringing grasses and clovers on what were originally bare, steep faces. The following notes were made on the occasion of the writer's visit on 13th June:—

Super plots: Even on faces and ridge cockfoot, rye-grass, and clover coming back in response to dressing. Pasture eaten very low by sheep and cattle, even fern-plants among the grass being eaten. Second growth in the shape of bracken fern on the adjoining control plot left untouched.

Nauru phosphate: On these plots fern has been eaten more than on adjoining control plots, but not so much as on super plots.

Basic slag: On first plot white clover coming back very thickly—more so even on poorer ground than on super plots. This plot easily best on area. Second basic-slag plot also shows excellent results.

Nauru phosphate and super plots: This mixture appears to have brought back white clover and danthonia at expense of moss and young bracken-fern plants.

Experiments in the Sounds have not proceeded far enough as yet for determining what increase in carrying-capacity may be expected from fertilizer top-dressing, nor just on what country it is going to pay to top-dress. Steps are being taken in the coming season to determine the economic position in regard to the sunny faces. Our plan is to proceed to deal with the country in order of its grade of fertility and its possibilities of improvement.

THE EAST COAST.

No very definite results have yet been obtained from the trials at Kekerangu, and report on this area is therefore deferred until another season's observations are available.

The Large White Pig in Denmark and Britain—Replying to a recent inquiry relative to the utilization of the Large White pig for crossbreeding purposes in New Zealand, the High Commissioner, London, states as follows: "Mr. Harald Faber, the Danish Agricultural Commissioner in London, informs me that the Large White pig is being used less in Denmark than formerly, and that it is gradually being replaced by the Danish-bred pig, which was considered to be more suitable for breeding purposes and for the production of pork. This Danish-bred pig is the evolution of crossbreeding which has been going on for some years, the basis being a cross between the native pig and the Large White. He was not able to give me detailed information as to whether or not the size of bone entered into the question. The Ministry of Agriculture of England states that the Large White is very popular in this country for the production of bacon, and that boars of the breed are in great demand for crossing with other breeds with the same object in view. It is further stated that the Large White is not generally regarded as an ideal pig, when kept pure, for the production of first-class pork, but is suitable for the purpose when crossed with such breeds as the Middle White and Berkshire."

A RECONNAISSANCE SURVEY OF PUMICE SOILS.

ROTORUA COUNTY.

(Series continued from June, 1926.)

B. C. ASTON, F.I.C., F.N.Z.Inst., Chemist to the Department of Agriculture.

V. MAPPING OF COUNTY BOUNDARY COMPLETED.

RESUMING this series of articles, certain facts may be briefly restated. Pumice soils are of many qualities, ranging from good to bad. It is the aim of this survey to classify the leading types of soil in the areas where pumice soils occur, so that the response to treatment of given types in the settled areas may be predicted for the same types occurring in the less settled and therefore less known districts, the climate being the same. In making any statements as to the quality of any soil in the volcanic soil-province it is highly desirable that the soil should be called by the right technical name. These names are all familiar terms, such as "gravel," "sand," "silt," "loam," prefixed by the adjectives "coarse" or "fine," and when the proportions are fairly balanced a compound name is used. Thus some half-dozen familiar words in different combinations may be used to describe accurately* all the kinds of soil dealt with in this article.

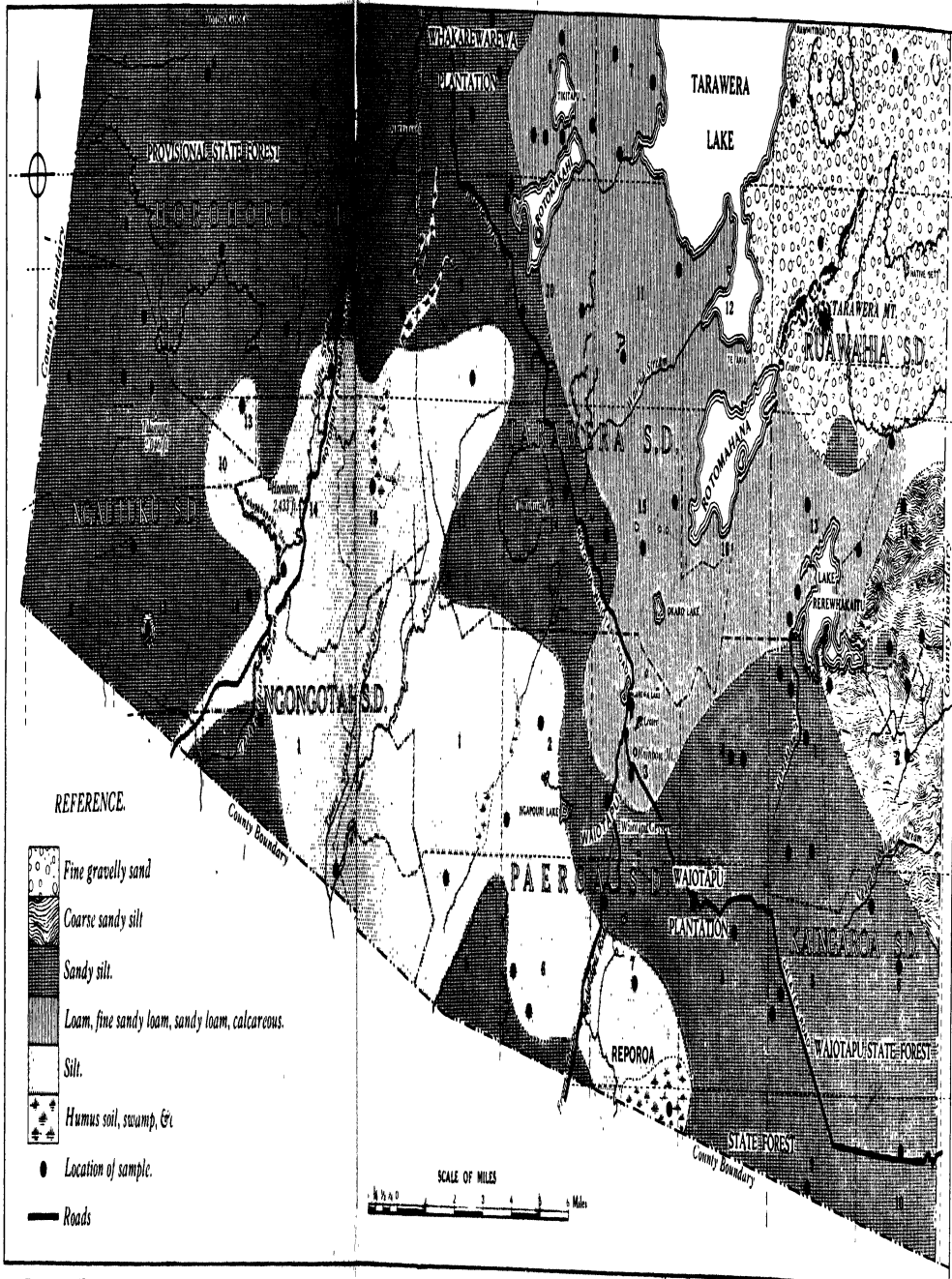
With the areas mapped and distinguished by a distinctive pattern shading for each soil-type, it will be easy for those interested to determine to what type any area belongs. It is not to be denied that small patches of soil may occur which are not representative, but the owner of such land must recognize the substantial accuracy of the mapping. This careful work—which has been the outcome of much laborious effort in the field and detailed investigation in the laboratory on the part of an efficient staff—again shows the persistence of each of the wind-deposited soil-types over a very large area. The findings of the work on the northern half of Rotorua County have been largely borne out in the results obtained in the southern half. These are presented in the accompanying map and tables.

As one would expect, those soils which have been distributed through air alone—not having been altered by running water—are uniform throughout their boundaries. In this southern map, however, two new conditions confront one which are highly interesting and probably of great economic value, for here is disclosed the presence of a very large area of water-borne soils of quite a distinct type (silts) from any yet found in the northern part of the county. Also there are—no doubt as a sequential effect—some smaller areas containing swampy soils. Evidently some river in the past has deposited this silt soil. The significance of this discovery is that iron-starvation (bush sickness) in ruminant stock is not known to occur in soils which are finer in texture than a sandy silt, *and here is a large area of finer soil than a sandy silt.*

* The limits of the use of each term are defined, each term denoting a soil with a definite proportion of particles of each size, the largest size being gravel and the smallest clay particles.

MAP OF SOUTH ISLAND OF ROTORUA COUNTY SHOWING DIFFERENT TYPES OF SOIL.

Blank show sites whence soil samples have been drawn in this survey.



To face page 96.)

Table 1.—Chemical Analyses of Soils, Southern Half of Rotorua County.
(Results, except *, are percentages on soil dried at 100° C.)

Laboratory Number.	Description of Soil.	Volatile Matter.		Total Nitrogen.	1-per-cent. Citric-acid Extract, Dyer's Method; Hall's Modification. ("Available Plant-food.")					Hydrochloric-acid Extract. ("Total Plant-food.")				
		* At 100°C.	On Ignition.		Lime, CaO.	Magnesia, MgO.	Potash, K ₂ O.	Phosphoric Acid, P ₂ O ₆		Lime, CaO.	Magnesia, MgO.	Potash, K ₂ O.	Phosphoric Acid, P ₂ O ₆	
X														
267	Composite sandy loam ..	1.64	4.43	0.070	0.146	0.043	0.028	0.008	2.00	1.42	0.50	0.10		
268	Composite fine sandy loam ..	1.19	3.22	0.045	0.144	0.040	0.033	0.011	2.22	1.25	0.62	0.04		
269	Composite silt ..	2.31	10.06	0.209	0.098	0.024	0.020	0.004	0.42	0.18	0.10	0.05		
270	Composite coarse sandy silt ..	0.87	4.24	0.076	0.085	0.027	0.018	0.004	1.64	0.89	0.21	0.02		
271	Composite sandy silt (Tarawera)	3.10	9.83	0.196	0.105	0.037	0.022	0.005	0.80	0.40	0.21	0.06		
272	Composite sandy silt ..	1.27	4.74	0.075	0.090	0.027	0.018	0.003	1.53	0.74	0.23	0.02		

Analyses by F. J. A. Brogan.

It does not appear that the essential difference in the quality of the Atiamuri Road silts from the sandy silts of the Rotorua series has been recognized before, or, if recognized, it has not been explained. Settlers have claimed, however, that their land here is not "bush sick," and science now supports them and supplies the explanation.

It is satisfactory to know that the area opened by the Lands Department under the "inferior lands for selection scheme" is situated on the silty soils of greater fineness than a sandy silt. The importance of a small increase in the fineness of the soil-texture has been fully stressed in previous articles. The increase of the clay content in one case from 1 per cent. to 5 per cent. has made all the difference between "healthy" and "sick" cattle-country.

The soils dealt with in this article will all come under series "C," a series first found on the east side of Lake Rotorua and consisting of varying depths of the mud and other material ejected from Tarawera. Chemical analysis sharply defines these soils from soils of the same texture belonging to another series, but the present article deals with seven types, whereas in the previous survey only two types were described (see *Journal*, June, 1926, p. 368). These were described fully in the *Journal* for December, 1924, pp. 378-79. Series "C" are usually finer than any other series of the Rotorua County, from which they are always characterized by the top soil having a much higher lime and magnesia content (neither present in the form of carbonate), and they may be regarded as the healthiest soils in the county.

In this article the following types of series "C" are enumerated in the decreasing order of their fineness; only Nos. 1 and 2 occur in the northern part of the county mapped in the *Journal* for June, 1926.

Type No.	Name.	Area	
1.	Sandy loam	}	60 sq miles.
2.	Fine sandy loam		
3.	Silt ..	..	103 ..
4.	Coarse sandy silt ..	..	22 ..
5.	Sandy silt (Tarawera S.D.)	}	290 ..
6.	Sandy silt ..		
7.	Fine gravelly sand ..	..	47 ..

Composite samples were made up from the individuals of the first six of these types and analysed chemically, with the result that all except No. 3 (silt) showed a close relation to the Te Ngae series ("C" types 1 and 2). With regard to the silt, in the chemical analysis it compared very favourably with the sandy silts of Marnaku (series "A"); in addition, the mechanical analysis is such that the

Table 2.—*Mechanical Analyses of Soils, Southern Half of Rotorua County.*

(Results are percentages on air-dried soil.)

Description of Soil. (Classification of United States Department of Agriculture, modified.)	Analysis of "Fine Earth" passing 2 mm. Sieve.							Stones and Gravel.
	Fine Gravel.	Coarse Sand.	Fine Sand.	Silt.	Fine Silt.	Clay.	Moisture.	Loss on Ignition.
Fine gravelly sands, Ruahia S.D.—								
Maximum	31.3	54.5	21.8	13.2	6.3	1.8	1.7	6.5
Average	27.0	39.0	16.9	7.5	3.2	1.0	0.9	3.7
Minimum	22.7	25.0	13.1	2.2	1.1	0.4	0.2	0.8
Coarse sandy silts, Kaingaroa S.D.—								
Maximum	22.8	43.7	23.3	18.4	9.4	4.3	1.4	5.5
Average	11.6	36.9	22.3	15.6	6.4	1.7	1.0	4.5
Minimum	5.6	20.0	21.1	12.9	3.1	0.9	0.8	4.1
Sandy silts, Ngautuku S.D.—								
Maximum	12.1	22.5	33.8	36.4	8.9	4.3	3.8	14.6
Average	5.9	15.8	26.6	30.6	5.9	2.5	2.5	10.9
Minimum	2.3	12.8	21.4	22.8	2.5	1.4	1.4	7.4
Sandy silts, Horohoro S.D.—								
Maximum	7.2	26.4	27.4	29.1	9.8	3.7	6.6	14.7
Average	4.9	17.7	25.0	26.8	7.7	2.2	3.8	12.4
Minimum	3.0	13.9	21.6	21.2	5.2	0.5	2.1	9.2
Sandy silts, Ngongotaha S.D.—								
Maximum	11.1	28.9	29.6	29.1	6.4	3.1	3.0	15.8
Average	7.3	20.8	24.6	25.8	5.2	1.8	2.7	12.0
Minimum	4.4	16.8	20.6	19.7	3.6	1.3	2.2	9.8
Sandy silts, Tarawera S.D.—								
Maximum	12.1	30.0	33.1	31.2	10.9	4.2	4.4	15.8
Average	6.6	19.8	28.0	23.0	7.7	1.9	3.3	10.1
Minimum	3.0	16.2	22.8	15.0	6.1	0.8	2.3	6.4
Sandy silts, Paeroa S.D.—								
Maximum	9.2	28.8	29.6	30.5	9.4	3.0	4.1	10.6
Average	6.4	18.4	26.6	27.7	7.2	1.6	3.1	9.4
Minimum	4.9	13.5	22.1	18.3	5.0	0.8	1.8	7.7
Sandy silts, Kaingaroa S.D.—								
Maximum	19.2	35.9	36.5	29.5	12.2	4.0	2.4	9.1
Average	6.0	24.8	29.9	22.6	7.0	1.8	1.4	6.0
Minimum	1.0	15.5	25.2	17.6	3.8	0.6	0.7	2.2
Sandy silts, all districts—								
Maximum	19.2	35.9	36.5	36.4	12.2	4.3	6.6	15.8
Average	6.0	19.8	27.3	25.8	6.9	1.9	2.7	9.7
Minimum	4.0	12.8	20.6	15.0	2.5	0.5	0.7	2.2
Silts—								
Maximum	5.3	13.4	32.7	38.1	16.1	5.6	8.4	18.4
Average	3.4	10.4	26.7	34.1	9.4	2.0	3.3	10.3
Minimum	1.3	4.9	14.1	29.7	6.4	1.1	1.5	7.7
Fine sandy loams—								
Maximum	7.1	11.7	38.5	25.9	17.0	11.5	1.2	4.5
Average	4.0	9.5	33.9	23.7	15.2	9.0	1.0	3.4
Minimum	2.5	5.8	30.0	21.8	12.1	8.4	0.8	2.4
Sandy loams—								
Maximum	22.3	30.5	32.9	28.7	19.3	11.1	2.2	9.3
Average	7.6	18.5	25.6	20.1	14.8	8.6	1.5	3.7
Minimum	2.2	12.1	17.0	13.1	10.8	6.9	1.0	1.0
Averages.								
Fine gravelly sands	27.0	39.0	16.9	7.5	3.2	1.0	0.9	3.7
Coarse sandy silts	11.6	36.9	22.3	15.6	6.4	1.7	1.0	4.5
Sandy silts	6.0	19.8	27.3	25.8	6.9	1.9	2.7	9.7
Silts	3.4	10.4	26.7	34.1	9.4	2.0	3.3	10.3
Sandy loams	7.6	18.5	25.6	20.4	14.8	8.6	1.5	3.7
Loams (only two samples analysed)	4.0	9.5	33.9	23.7	15.2	9.9	1.0	3.4

Analyses by L. D. Foster, assisted by D. F. Waters and E. B. Davies. Samples collected by R. E. Grimmer.

series "C" silt in its fineness and consequent capacity to hold water is greatly superior to the series "A" sandy silt. Series "C" offers a very good example of the necessity for classifying the soils of the same mechanical fineness into series according to their chemical as well as their physical characters. The two sandy silts of series "C" are greatly different from those of series "A" in their chemical composition, and no doubt in their productiveness and freedom from iron-hunger.

Some Features of the Volcanic Soil-province.

The following are some of the outstanding features which confer distinction on soils of the volcanic soil-province when compared with other normal soils of the North Island which are devoted to the same kinds of farming.

It cannot be denied that those lands in the soil-province which are not already closely settled (such as are those in the Rotorua Lake basin) are cheap compared with other lands of similar productiveness in the North Island. The soil is such that with few exceptions it may be worked in all weathers. It is comparatively accessible, and service motor-coaches ply with great regularity throughout the year and connect with the railway services at the Rotorua rail terminus with the East Coast Railway and with the Napier Railway terminus. Throughout the North Island there are many instances of fertile lands with poorer means of access.

The climate may be claimed as one of the best in the world, and although the rainfall is high the water gets away remarkably quickly through the porous soil, so that except in one respect this country is an ideal one for both man and animals. The freedom of locally raised stock from tuberculosis has been noted, and the writer believes this feature also applies to the human population. The absence of tubercle is, indeed, so remarkable as to prompt inquiry as to the cause. The writer—in many analyses of the natural waters of this district, whether surface waters or those from springs or rivers—has always found an excess of dissolved silica to be present in the total mineral matter left after evaporation of the water, and it is an interesting fact that silica is used in medicine as an alleviative of some forms of tuberculosis in humans. Gonnermann ("Biochemistry of Silicic Acid," 1917) has observed that silica is present in most animal tissues, and that good results have been observed to follow the administration of silicic acid in cases of tuberculosis. Most herbs contain considerable quantities of silica, and it is found on analysis that those herbs which are used by the country folk of Middle Europe for the cure of tuberculosis contain the largest percentages of silica (Abstract in the *Journal of the Chemical Society*, August, 1917, vol. 112). People of weakly constitution and others with weakly children coming to live in the pumice country often experience great relief from anxiety on the score of health after a few months' residence.

The health of stock is remarkable in yet another respect—freedom from bone-nutrition troubles. Disease of the bones often occurs in certain districts of the North Island in certain years, especially in milking-cows. The absence of this trouble on the pumice lands seems to show that the amount of the bone-making minerals in the soil and pasture never sinks below that required for the production of healthy

bones in the animal. A very small amount of phosphate is shown to be present in the soil by methods designed to estimate the available or the total phosphoric acid, and this is another fact that requires an explanation.

Clovers thrive amazingly on all the pumice lands, and the clover is a plant which likes phosphates and potash to be present in the soil in good amount. But available silica has the faculty of making phosphates more assimilable by the plant within the plant, so that if silica is available in the soil and is taken up more freely by the plant than is usually the case, the plant may be enabled to assimilate more phosphoric acid than it would otherwise. It is not to be denied, however, that phosphates are destined to play an important part in the development of this volcanic country.

Phosphates improve the carrying-capacity of all types of soil by increasing the quantity and quality of herbage per acre. The fact that this soil-province is situated comparatively near to the great phosphate receiving and distributing centre of Auckland City is another fact in favour of the pumice land as a whole. In connection with the coarser grades of pumice, for anything coarser than a silt it is best to keep the soil-reaction acid, which inhibits the use of such alkaline dressings as are supplied by most forms of lime. There is no doubt that lime will have to be distributed on many North Island lands in increasing quantities in the future, but on the coarser pumice lands it will not be good practice to apply lime for very many years; not only is lime now unnecessary, but it is even harmful. Thus another point in favour of pumice lands is that the expensive practice of liming may be dispensed with. The three fertilizer ingredients—nitrogen, potash, and phosphoric acid—are arranged thus in the order of their cost. Nitrogen is most expensive, potash comes next, and phosphates are the cheapest per unit. Now, all pumice lands, even when unmanured, grow clovers and leguminous plants freely, thus providing a useful method of supplying nitrogen when the plant-roots decay in the soil or a leguminous crop is ploughed in. Potash is already abundant in the soil, so that the only ingredient to be supplied is the phosphate, the cheapest of all three fertilizers.

The volcanic soil-province is fortunate in having many subsidiary sources of income. The tourist traffic supports the thriving town of Rotorua, with its famed sanatorium, and provides a source of revenue to near-by farmers who are farming on healthy country. The traffic is also largely responsible for keeping open the many highways and constant communication with all parts throughout the year.

Sawmilling employs numbers of hands, and is one of the most important industries of this area. Cheap timber of excellent quality is thus provided. The sawmiller is the logical precursor of the farmer in timbered country, making tracks and tramways in all directions.

Many industries which may help to cause the pumice lands to flourish are in their infancy, but they will undoubtedly grow and prove an additional source of revenue to these lands. Pumice-powder for insulating and other purposes has merely to be dried, ground, and bagged. Sulphur will be a great asset if deposits can be located sufficiently large to work. At present practically all the sulphur required for manufacturing purposes in the Dominion is imported from America.

Pumice soil is one of the best for raising horticultural plants from seed or cuttings. It has a peculiar character which may be termed a frothy porosity, which is unequalled for establishing young plants. All kinds of horticultural plants, whether herbs, shrubs, or trees, could be raised in this area, and supplied to less fortunate localities as very hardy, well-rooted plants, with an abundance of fibrous roots. The Rotorua Sanatorium gardens well demonstrate the horticultural possibilities of the district, for the abundant rainfall, porous soil, and genial climate have certainly here produced wonderful results.

The forestry possibilities of the pumice country are now fully recognized, and commercial organizations are following the lead given by the Government by investing large sums in establishing exotic plantations. The artificial growing of flax is one to be experimented with in the future. The soil seems singularly suited to the growth of *Phormium tenax*.

Poultry and pig farming are capable of great development. The pumice lands are adjacent to the Bay of Plenty, which grows maize to perfection. Clovers, artichokes, peas, and other legumes grow well and make excellent food for pigs. Bee-farming is likely to afford an excellent side line to the farmer on country where clovers grow to such excellence.

Why, then, with all these advantages do the pumice lands lag behind in farming development? It would seem that there is one main explanation—the fear of “bush sickness” is the deterrent to a much closer settlement, and the absence of any authoritative guide, with reasons, as to what is “sick” and what is healthy country, results in the whole area receiving the same stigma. It is the aim of the present soil survey to differentiate lands of varying quality, mapping and applying appropriate names to each type. Eventually it is hoped to publish a map which will without any doubt set down the definite areas which are unhealthy, together with the relative degree of unhealthiness for ruminant stock which each type of soil exhibits. This knowledge can then be used in combination with the appropriate methods of farm-management which have been demonstrated so successfully at the Department's Mamaku farm and elsewhere.

(To be continued.)

Handling of Fat Stock in Transit—The following remarks are made in the annual report of the Meat Producers Board for 1926-27. “The Board would again take the opportunity of pointing out to farmers and buyers handling stock the importance of the careful handling of all fat stock whilst in transit to freezing-works. It may not be generally known that a great many lambs graded second class are put into this grade on account of bruising, and from investigations made by officials of the Board it has been found that a good deal of this bruising has been caused through pulling the lambs by the wool, particularly in trucking. The loss that takes place from this cause should be a matter of concern to every farmer. As an illustration of the damage which takes place in this direction it may be noted that in a report received from one of the Board's graders he mentions that in a lot of lambs inspected at a freezing-works he counted 101 second class, forty-three of which would have gone into the prime grades but for bruising, whilst a number of the second-quality lambs were also bruised, and out of ten rejections seven were on account of bruising.”

GOVERNMENT CERTIFICATION OF SEED POTATOES.

SYSTEM TO BE INITIATED IN CANTERBURY.

J. W. HADFIELD, Instructure in Agriculture, Christchurch.

THE Fields Division of the Department of Agriculture has arranged to initiate a system of certification of seed potatoes within the Provincial District of Canterbury during the coming season, 1927-28. If the scheme receives due support from growers, merchants, and seedsmen it is intended to extend it in succeeding years to embrace the whole of the Dominion.

Certification of seed potatoes has been adopted by a number of other countries, and the principle has in most cases been extended to include other farm-produce used for seeding purposes, such as cereals, clovers, lucerne, and grass-seeds. While, however, there is ample scope for such extension in New Zealand, the most urgent need would appear to be in connection with potatoes, owing to the present very unsatisfactory standard.

The object of potato-certification is to place before growers, merchants, and seedsmen information which will enable them to obtain "seed" true to name and free from serious disease. Obviously, this will necessitate inspection by qualified inspectors of both the growing crop and the produce derived from that crop. With a view to stimulating the distribution of such seed, and as a measure of protection against misrepresentation, growers of certified seed will be registered, and to each will be issued a certificate and a sufficient number of certification-tags to enable one tag to be attached to each sack of certified potatoes. Further, it is proposed to publish the names of such certificated growers in the *New Zealand Journal of Agriculture*.

REASONS FOR INTRODUCTION OF POTATO-CERTIFICATION.

(1) *Mixed State of Varieties.*

Every one associated with the potato trade in this country--either as grower or dealer--will readily acknowledge that varieties are badly mixed and sometimes incorrectly named. For example, during the season 1926-27 sixty-two lines, consisting of twenty-one varieties of potatoes, were grown at the Ashburton Experimental Farm. These had been collected from seedsmen and growers in Canterbury, Otago, and Southland, and, in view of the object for which they were collected and a definite request that they should be true to name, were almost certainly representative of a higher standard than that existing in the general crops of the Dominion. Of these sixty-two lines, seven were wrongly named, and the remainder contained an average of 7.8 per cent. of rogues. Northern Star, or Gamekeeper, proved to be by far the most common impurity in the white-skinned potatoes, and the proportion will increase at a remarkable rate owing to the tendency of this variety to produce an abundant crop of seed-size tubers.

The Dakota is an example of a variety of undoubted merit now rapidly going out of favour owing to the presence among it of yellow-fleshed varieties of poor cooking-quality (Scotia and Russet Reading), and of varieties in which the pink coloration sometimes extends into the flesh.

Extensive areas of potatoes are being grown and the produce sold under incorrect names, and in a few cases two closely similar varieties have merged into one mixture which is sold under the name of either. The position has become so unsatisfactory that there is a demand from all sides for seed potatoes which are true to name. Certification will undoubtedly fill this need, and at the same time record type descriptions, and clear up the confusion existing in regard to nomenclature of varieties that are being grown commercially in New Zealand.

(2) Prevalence of Disease.

To the merchant and grower varietal impurities will represent the most urgent need for certification. The fact remains, however, that in New Zealand, as in other countries, disease is really the more important factor and is causing very serious loss to the grower. Examination of crops during the past season has revealed conditions that are far from satisfactory, more especially in connection with those diseases that are not commonly recognized by growers—for example, corticium, and virus and wilt diseases.

In the trials previously referred to, conducted at the Ashburton Experimental Farm, a count was made of those plants obviously below the general standard—somewhere about 50 per cent. or more. It was made regardless of the cause, and revealed 26·7 per cent. of subnormal plants. Exactly how much loss is being experienced by growers is difficult to estimate, and investigation along these lines is being undertaken. Indications are that the loss must be of considerable importance, yet these conditions are those not generally recognized as specific diseases, although the farmer will readily acknowledge that his seed has “run out,” and that a change is desirable.

The Up-to-Date still remains one of our best commercial varieties, provided a satisfactorily healthy strain can be procured. Some very fine crops of this variety are still grown, but it appears particularly liable to infection from wilt, and crops that are even moderately free from this disease are comparatively rare. Mr. J. W. Calder, of Canterbury Agricultural College, is at present engaged in raising a strain free from this disease, and during the past season (from four long rows in the paddock) has compared the yield from wilt-infected shaws with that obtained from plants showing no sign of infection. The results supplied by Mr. Calder for the one season and the one crop are an indication of the possible loss occasioned.

Number of plants dug	..	..	500.
Number of healthy plants	..	..	88 = 17·6 per cent.
Number of wilt-infected plants	..	..	412 = 82·4 per cent
Actual yield of 88 healthy plants	..	..	190 lb = 100 per cent.
Actual yield of 88 diseased plants	..	..	65 lb. = 34 per cent.

Since no means of direct control is applicable to the great majority of potato-diseases, avoidance of sowing diseased seed would appear to be the most practical method of improving conditions as they are

at present. Many of the diseases can be recognized only while the crop is growing, by one who is acquainted with the symptoms, and an essential part of the certification system is the accurate estimation of the proportion of these diseases at regular periods of inspection. Avoidance of the disease is effected by certifying clean crops, thus stimulating the distribution of healthy strains and indirectly suppressing the use of unsatisfactory seed.

Progress may not be rapid, because it must be recognized that in some cases infection is transmitted in the field by various agencies and from year to year in the soil. The fact remains, however, that the use of infected seed is the primary cause of the distribution of these diseases. E. J. Fawcett pointed out in this *Journal* for November last that in Canterbury less than 2 per cent. of farmers grow potatoes after potatoes, and over 76 per cent. grow them following grass. Under these conditions one would be justified in supposing that soil-infection is not a very important factor in the distribution of potato-diseases.

There are growers who regularly and successfully produce pure seed, but there is not sufficient of this to meet the demand, nor any organized attempt at the elimination of disease beyond the very excellent practice of planting cut sets of table potatoes every few years.

WHY GROWERS AND MERCHANTS SHOULD SUPPORT CERTIFICATION.

The present position of a farmer desiring a change of seed is far from satisfactory. A change is certainly desirable, provided he is satisfied that the seed being introduced is definitely better than his own, but so frequently does this practice lead to disappointment that obviously some system of certification would be of material assistance in indicating to the purchaser the best crops from which to obtain his seed. There is always an element of risk unless he is actually acquainted with a grower of pure seed and has had an opportunity of inspecting the growing crop.

The purchase of seed on the open market, without any knowledge of its origin or of the quality of the crop from which it was produced, is a risk which no commercial grower should be forced to take. As already indicated, in many instances the presence of disease can be detected only by an examination of the growing crop, and recent work at the Ashburton Experimental Farm clearly indicates that what appears to be an excellent line of seed may be incapable of yielding more than a few sacks of table potatoes to the acre.

The merchants are also faced with difficulties in the handling of seed potatoes. Certification will play no part in the supervision of grading standards, but it should most definitely assist merchants in determining the suitability of crops for seed purposes. It is unavoidable that a large proportion of seed submitted to merchants is the produce of crops that have not been inspected during growth, and sales are arranged according to the appearance and grading. As this amount of evidence is not sufficient indication as to the value of a line for seed purposes, it follows that purchases are made with little confidence. Seedsmen and merchants are the first to acknowledge that if it were possible to remove the element of risk and uncertainty in the purchase of seed potatoes they would be in a position to pay a higher price to

the producer. It may be assumed that certification will assist in this direction, and that part of its value will be reflected in the higher prices paid to growers for certified seed.

VARIETIES ELIGIBLE FOR CERTIFICATION.

Obviously, it would be impossible to certify in regard to all varieties grown in New Zealand. As a result of inquiries made from merchants throughout the South Island it has been decided to include within the scope of the first year's operations the following varieties :—

Arran Chief.	Aucklander—Short Top.	Early Regent.
Dakota.	Sutton's Supreme.	Early Puritan.
Bresee's Prolific.	British Queen.	Robin Adair.
Gamekeeper.	Epicure.	King Edward.
Northern Star.	Pink Beauty of Hebron.	Magnum Bonum.
Up-to-Date.	Early Rose.	Endurance.
Aucklander—Tall Top.		

THE GROWER'S PART.

Any one intending to plant on his own land or on contract during the 1927 28 season 1 acre or more of a pure line of any of the above-listed varieties may make application for certification on a form supplied for the purpose and available from the Instructor in Agriculture, Christchurch. Applications must be forwarded to the Manager of the Experimental Farm, Ashburton, and be accompanied by 100 seed-size tubers, freight paid. Applications close on 30th September, and, for reasons already explained, will be restricted during the coming season to areas grown in Canterbury. In the event of a crop passing the necessary standards the owner will be required to keep and submit a record of sales.

Prices and standards of grading are matters outside the scope of certification, but it is necessary for the Department to keep a record of those to whom certified seed is sold and the quantity of each sale. This means that the responsibility is upon the grower to account for the exact number of certification-tags issued to him, and this affords the only means by which the Department can trace any particular line in the event of misrepresentation and complaints.

INSPECTION OF CROPS.

The trial sample submitted by the grower will be planted under uniform conditions with all other lines submitted, and thus enable a ready comparison to be made between the standard of any one and that of the rest of the samples submitted. The first field inspection of the farmer's crop will take place during January, and the second inspection just prior to the shaws maturing. Final tuber-inspection will be made after harvest, when the tubers have been graded and are in sacks. These sacks need not be those in which the tubers are to be marketed, but it will be impossible to certify seed that is in pit, and it is essential to the satisfactory working of the system that the number of certification-tags issued shall correspond with the number of bags for sale.

STANDARDS.

Standards will be set during January of each year, after careful examination and comparisons have been made of the plots grown from the samples submitted by growers.

A uniform system of counting will be adopted at each inspection, in order to determine the percentage of foreign and diseased plants present. Standards will be progressively higher with each inspection. A crop containing 5 per cent. of foreign varieties at the time of the first field inspection may pass at that stage, but the grower will almost certainly be called upon to rogue the crop and materially reduce this percentage to enable it to pass the second field inspection. Information along these lines will be given by the Inspectors at the time of inspection.

ISSUE OF CERTIFICATES AND CERTIFICATION-TAGS.

A certificate will be issued to the grower in regard to each variety that passes the necessary standard, together with sufficient certification-tags to enable him to attach one tag to each sack of certified tubers that he sells from his farm for seed purposes. The tags are in the nature of a guarantee by the grower as to the contents of the sack to which the tag is attached. They will be printed on each side respectively as follows:—

[*On the front.*]

NEW ZEALAND.

GOVERNMENT-CERTIFIED SEED POTATOES.

Variety	.....
Name of grower	.....
Date	.....
Regd No	.....
	..... Inspector

[*On the back.*]

This tag is issued for one sack of potatoes of between 180 lb and 200 lb gross weight, and is to certify that satisfactory evidence has been given that the contents have been grown by the person whose name it bears, and that they have been inspected in the field and after harvest by an officer of the Department of Agriculture, and have been found sufficiently vigorous and free from serious diseases, other pests, and foreign varieties as to warrant them being classed as Government-certified seed potatoes. This tag is issued on the express condition that the person to whom it is issued and whose name it bears undertakes to grade the potatoes for which it is to be used, so that they shall be practically free from earth, rotted or otherwise seriously injured or blemished tubers, free from all foreign or off-type tubers, and that the grading shall be in accordance with arrangements entered into between the said person and the purchaser, and on the further condition that the said person assumes entire responsibility for the contents of any package to which this tag may be attached by him.

APPLICATIONS FOR CERTIFICATION CONFIDENTIAL.

A grower may make application for certification with full confidence that no publicity whatsoever will be given in regard to his crop until such time as it has been passed and certified. The fullest publicity will then be given in regard to growers' names, varieties, and quantity of seed available. A grower, therefore, need have no hesitation in applying, for he loses nothing by entering and failing, and may gain much by entering and passing.

CONCLUSION.

There are bound to be many difficulties ahead of certification, and it is only by the whole-hearted support of growers and merchants, and their free and constructive criticism, that the scheme will be carried through to a successful issue.

PARASITES OF THE PEAR-MIDGE (*Perrisia pyri*).

COLLECTION OF MATERIAL IN FRANCE, 1926.

R. C. FISHER, B.Sc., Ph.D., Imperial Forestry Institute, Oxford.

DURING 1925 a first attempt was made to collect in France parasites of the pear-leaf-rolling midge (*Perrisia pyri*) for shipment to New Zealand. A description of the work carried out in the Dominion by the Government Entomologist, Mr. David Miller, on receipt of the consignments despatched to Wellington, was published in this *Journal* for June, 1926. Of the hymenopterous parasites observed in France (a species of *Platygaster*, a species of *Inostemma*, and possibly two species of chalcid) the *Platygaster* was the most abundant. Mr. Miller relates that from the 1925 consignments forty-six female and twenty-six male *Platygaster* adults emerged in New Zealand. Only one specimen of a chalcid and no *Inostemma* adults were obtained in New Zealand from this collection of material from Europe.

A request was made by the New Zealand Department of Agriculture for further supplies of parasitized *Perrisia* material from France during the summer of 1926. As was pointed out in the report on the 1925 collection, work had been undertaken rather late in the season to hope to obtain the maximum quantity of parasitized midge-larvæ. Accordingly it was requested that consignments be sent out during the whole summer at regular intervals. The matter was placed in the hands of Dr. G. A. K. Marshall, of the Imperial Bureau of Entomology, who asked the writer if he could again undertake the collection work in France. Owing to his duties with the Forest Products Research Laboratory the writer was unable to proceed to France for a long period to undertake the work personally, as in 1925. He proposed to visit France for a week in order to find some one to carry out the collection of material during the summer and in order to organize such a scheme. Leave was obtained for this, and in the beginning of July, 1926, the writer proceeded to Paris, to the Station Entomologique, Dr. Paul Marchal's laboratory, from which collections had been carried out along with Dr. J. G. Myers in 1925.

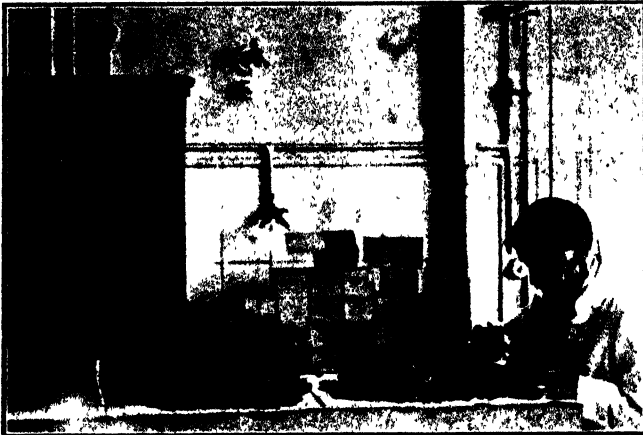
COLLECTION OPERATIONS.

Arrangements were made with M. Lucien Bru, *préparateur* at the Paris entomological laboratory, for larvæ of *Perrisia pyri* to be collected and despatched to the High Commissioner for New Zealand in London throughout the period from July to October. It was extremely fortunate to secure the services of M. Bru, who had seen this work carried out the previous year and could be relied upon to undertake it with enthusiasm and care. M. Bru spent several days in company with the writer, in orchards in the neighbourhood of Paris, searching for localities in which the pear-midge was most abundant, and becoming thoroughly acquainted with the type of material he had to collect. The majority of the collections were made from the same orchards as the 1925 consignments—at Versailles and at Seau-Robinson. Two collections, however, were made at Angers, in the Anjou district of France, where, in July, a severe *Perrisia* infestation

was noticed by M. Trouvelot, entomologist at the Station Entomologique, Paris. M. Trouvelot himself very kindly undertook to arrange for collection in this locality for the July consignment. In September a further supply of material was collected from Angers by M. Bru. Full particulars regarding the localities from which each consignment had been gathered were included with the material when shipped to New Zealand.

PACKING AND DESPATCH.

In all, four consignments were despatched during the summer. Larvæ of *Perrisia pyri* were collected in the rolled-up attacked pear-leaves. These were kept in an ice-chest in the laboratory at Paris at a temperature of from 12° to 14° C. during the months of July and August. In this way it was hoped to retard the development in Europe of both host and parasite larvæ. Each month a consignment was



PREPARATION OF CONSIGNMENT OF PARASITES AT THE PARIS ENTOMOLOGICAL STATION.

Showing M. Bru at work on pear-leaves containing larvæ of *Perrisia pyri*; ice-chest in background.

prepared for shipment and despatched to London. The procedure was as follows: Pear-leaves containing larvæ of *Perrisia* were packed among damp sterilized sphagnum moss in small boxes, 4½ in. by 3½ in. by 2½ in. in size. A layer of sphagnum alternated with a layer of attacked pear-leaves. The sphagnum moss had been treated to a high temperature in an autoclave to ensure the destruction of any organisms which might have been present in it. The accompanying photo illustrates the preparation of the September consignment by M. Bru. The small boxes were then tied up in pairs and sent per registered post to the High Commissioner for New Zealand, London, to arrive there three days before the date of departure of a vessel for Wellington. Dates of sailings had been obtained previously from the High Commissioner's Office in London, and arrangements made for cold storage, if necessary, prior to the packages being placed in the vegetable-chamber of the boat for shipment to New Zealand. Care

was taken to ensure that as little time as possible elapsed between the departure of the material by post from Paris and its disposal in the vessel at the London docks. The size of each consignment varied, the greatest quantity being sent in August and September.

The following table gives a summary of the size of each consignment, together with the dates of despatch from Paris and London, as well as the localities from which each had been collected :—

Consignments of Perrisia pyri Larvæ despatched from France, Summer, 1926.

Consign-ment No.	Date of Postage in Paris.	Date of Sailing of Vessel from London and Name.	Number of Parcels in Consign-ment.	Total Number of Small Boxes.	Locality of Collection.
1	July 22	July 28 ; s.s. "Remuera"	9	14	Versailles, Angers, and Seau-Robinson
2	Aug. 21	Aug. 28 ; s.s. "Rotorua"	8	16	Versailles and Seau-Robinson.
3	Sept. 18	Sept. 22 ; s.s. "Ruahine"	10	20	Versailles, Seau-Robinson, and Angers.
4*	Oct. 15	Oct. 25 ; s.s. "Port Melbourne"	6	12	Versailles and Bordeaux (one box).

* Delayed in post during transit from Paris to London. missed boat sailing on 20th October, for which consignment was intended; kept in cold store in London till 25th, when it left by s.s. "Port Melbourne."

EMERGENCE RECORDS FROM CONTROLS, OXFORD.

In addition to the foregoing, each month one control box of parasitized material was sent by M. Bru to the writer at the Imperial Forestry Institute, University of Oxford. On arrival in Oxford the controls were placed in parasite emergence cages, and records were kept of emergences from these, a summary of which follows :—

Consignment 1 (July, 1926).

The material in this control box was collected at Versailles on 7th July. Placed that evening in an ice-chest at the laboratory in Paris, it remained there until 10th July, when it was packed exactly as though for shipment to New Zealand, but was conveyed by the writer to his laboratory at Oxford on 12th July. Active *Platygaster* adults were observed in the orchards from which this control was gathered. The parasites noted in the field in the beginning of July were seen darting hither and thither from leaf to leaf on *Perrisia*-infested trees. As has been remarked by Dr Myers and by Mr Miller, the parasites showed greatest activity in bright sunshine.

The following emergences were noted from this control :—

End of July : A few adult *Perrisia*.

11th August : 8 dead *Perrisia* in tubes ; 3 parasites (*Platygaster* sp)—very active.

18th August : 7 parasites (*Platygaster*).

21st August : 8 parasites (*Platygaster*).

14th September : No further parasites since 21st August ; 9 midges *not Perrisia*.

20th September : *Midges (*not Perrisia*) alive, 10, dead, 7.

25th September : 9 *Sciara* midges.

29th September : Swarms of *Sciara* midges. Midges of this species continued to appear until the middle of October.

No further *Perrisia* adults or parasites made their appearance in the emergence-tubes ; and no activity noted to date (25th February, 1927).

* Identified by Mr. P. H. Grimshaw, of the Royal Scottish Mus-um, Edinburgh, as species of *Sciara* which live in decaying vegetable matter.

Consignment 2 (August).

Controls collected from Versailles on 18th August and placed in emergence-boxes at Oxford on 23rd August.

14th September: Midges present in tubes of *Perrisia* and *Sciara* spp. 1 parasite (chalcid) in tube.

21st September: *Sciara* midges, 10; *Perrisia* midges, 2. Mites of unknown species noted in tubes, and apparently feeding on dead midges.

25th September: *Perrisia*, 1; *Sciara* midges, swarms; parasites (*Platygaster*), 2.

4th October: Large numbers of *Sciara* midges still emerging. Parasites (*Platygaster* sp. ?) also in large numbers, but whether from *Sciara* or from *Perrisia* impossible to say.

12th October: Parasites, 3; *Sciara*, 18.

21st October: *Sciara*, 1.

No further activity to date (25th February, 1927).

Consignment 3 (September).

Controls collected at Angers on 15th September; despatched from Paris on 18th September; reached Oxford and there placed in parasite emergence-boxes on 20th.

12th October. *Perrisia* in tubes, 7. No further activity to date (25th February, 1927).

Consignment 4 (October).

Controls collected at Versailles during the second week of October. One box was sent from Bordeaux. The Versailles controls were despatched from Paris on 16th October, and were placed in parasite cages at Oxford on 20th.

No emergences of any sort were observed from this material to date (25th February, 1927).

CONCLUSIONS.

In summing up the results of the emergence records of the controls, it is interesting to note the large numbers, first, of *Sciara* midges which issued from the material in August and continued to appear throughout the summer, gradually falling off towards the end of September and the beginning of October. The appearance of these insects was followed by the emergence of large numbers of parasites, apparently of a *Platygaster* species. At the beginning of this period, however, some few adult *Perrisia* also were found in the emergence-tubes. The question at once arises whether these parasites came from the *Sciara* midge larvæ or from larvæ of *Perrisia*, or possibly from both. One is inclined to the opinion that they were parasites of the *Sciara* species, but it has not been possible to determine this. The parasites obtained from the different control boxes have not yet been named.

The presence of *Sciara* among the material is in itself of interest, and shows the possibility of large numbers of this insect, together with its parasites, being reared in New Zealand from the actual consignments of *Perrisia* sent from France. At first it was suspected that these midges might have come from the sphagnum moss used in the packing of the pear-leaves. It was ascertained, however, that according to instructions all the sphagnum moss used had been sterilized at a high temperature (120° C.) in an autoclave before packing. In this way all life present in the moss must have been destroyed. It appears, therefore, that the *Sciara* midges must have come from the pear-leaves themselves. On arrival in Oxford these were kept free from all source of contamination, and one could thus be certain that everything emerging from the parasite-boxes originated from the pear-leaves and had been present in them when collected in the orchards in France.

It is not surprising that these scavenger midges (*Sciara*) should be found in such material. Very frequently a pear-leaf containing *Perrisia* larvæ and severely attacked by them is quite black and decayed, and, possibly, would afford suitable breeding-ground for such an insect as a species of *Sciara*, which feeds on decaying vegetable matter.

One hoped that the best results would be obtained in New Zealand from the consignments sent out in August and September. The October consignment, sent out several weeks earlier than the corresponding despatch in 1925, was small; material was difficult to find, since the majority of the pear-leaves had fallen to the ground, carrying the wintering midge-larvæ with them. There was always the possibility, however, that these larvæ might contain just as many parasites as those of other consignments, and it was because of this that the collection in France was extended to include October.

No work was carried out during the summer in France on the biology of the parasites, nor a study made of the part they played in the control of the pear-leaf-rolling midge in Europe. All that was undertaken was a collection of larvæ in districts in which it was known from the work in 1925 that parasites were to be found.

It is with great interest that one follows the work of acclimatization, rearing, and breeding of the parasites obtained from these consignments, in New Zealand, by Mr. Miller. Such work must necessarily be conducted first of all on quite an experimental scale, in strictly enclosed insectaries in pear-midge-infested localities. One can never forecast the results of an attempt at biological control of any injurious insect, but one hopes that Mr. Miller's work will achieve every success, and that in time, when a complete knowledge has been obtained of the life-cycle of the parasites, and when hyperparasites, if any, have been eliminated, the introduced parasites will become so acclimatized and of such value that the ravages of *Perrisia pyri* in New Zealand may eventually be greatly reduced and this insect no longer be regarded as a serious pest.

APPRECIATION.

In conclusion, the writer wishes to thank Dr. Paul Marchal for so kindly granting, once again, facilities in his laboratory for work during the brief visit to Paris in July. Thanks are due to M. Trouvelot for his help and for arranging the collection of the July consignment, and to Dr. Feytaud for procuring material from Bordeaux in October. M. Pinelle very willingly granted permission again for collection to be carried out in the extensive orchards of the Ecole d'Horticulture at Versailles. Finally, special thanks are due to M. Bru for the efficient and careful manner with which he carried out the work during the whole season.

NOTE.—A report by Mr. Miller on the consignments of material described by Dr. Fisher, as received and dealt with in New Zealand, will be published in next month's *Journal*.—ED.

Foot-and-mouth Disease in England.—Cabling last month, the High Commissioner, London, advised an outbreak of foot-and-mouth at Tamworth, in Staffordshire. This was the first case since April last, and all movement restrictions had been withdrawn by the Ministry of Agriculture in May. A further cable from the High Commissioner, dated 4th August, advised four more outbreaks at Tamworth and three in Kent.

MANURING OF ORCHARD TREES.

EXPERIMENT WITH APPLES IN BLENHEIM DISTRICT.

M. DAVEY, Orchard Instructor, Blenheim.

SOME two years ago the Marlborough Fruitgrowers' Association, having arrived at the conviction that the time had come when it was impossible to produce profitable and maximum crops of apples without the aid of fertilizers, requested the Horticulture Division of the Department of Agriculture to conduct a local manurial experiment on behalf of the growers. The aim of the experiment was to determine the quantities and more particularly the proportions of nitrogenous, phosphatic, and potassic manures most suitable for the district, by which improvements such as renovation of debilitated trees and increased yields could be obtained.

The use of two orchards was secured, those chosen being the properties of Messrs. T. H. Torode and A. MacDonald, situated at Fairhall. These orchards were selected as being typical of the majority of those planted in the district—consisting of comparatively small trees in heavy bearing and declining in vigour, planted on light land with gravelly subsoil, and alternately carrying heavy and light crops. The trees experimented with were twelve years old and from 8 ft. to 10 ft. high.

The writer, acting in conjunction with Mr. Torode, carried out the experiment and noted results. The trees selected for the experiment were leading export varieties, as shown in the tabulated results. The varieties, which extended across the two orchards, were treated in blocks of fifteen, three trees wide and five trees deep in the rows. Owing to necessity there was one exception to the number of trees in the groups, only twelve trees of Rome Beauty being incorporated in the blocks of this variety.

In No. 1 experiment 5 lb. of manure per tree was used, and in No. 2 experiment 10 lb. per tree. Between these plots three rows of trees, five trees deep in the rows, received no manure, the centre row only being regarded as a check row for noting obvious results, while the yield was taken from all three rows. A special trial was made with two individual trees for purposes set out in Experiment No. 3. Details of the experiments and results are set out in the accompanying tables.

Application of the manures was made on 17th September, 1925, with the exception of the nitrate of soda, which was applied at the pink stage of blossom-development on 12th October. The general manures were surface-sown prior to ploughing, which was carried out one month later. Unfortunately, the growing season following the application of the manures was excessively dry, the rainfall for the six succeeding months being as follows: October, 2.63 in.; November, 0.57 in.; December, 0.74 in.; January, 1.73 in.; February, 2.63 in.; March, 3.32 in.—making a total of only 11.62 in. of rain over the whole of the period from which results could be expected. Owing to this adverse condition prevailing it was decided to allow the experiment

Experiment No 1 - 5 lb. Manure to each Tree.

Variety treated and Number of Trees.	Manure applied to each Tree.	Yield in Bushels by Manured Trees.			Yield in Bushels by Unmanured Trees.			Remarks, 1926 Season.	Remarks, 1927 Season.
		1926.		Total.	1926.		Total.		
		1927.			1927.				
Ballarat Seedling (15)	{ 4 lb. super 1 lb. nitrate soda 1 lb. sulphate potash }	28	24	52	17½	17½	31½	No increase in growth over unmanured area	90 per cent. fully developed fruit-buds on manured trees; 60 per cent. only on unmanured. Second successive heavy crop.
Dunn's (15)	{ 3 lb. super 1 lb. nitrate soda 1 lb. sulphate potash }	17½	31	48½	12	21½	30½	Nitrate of soda in combination showed improved growth over same variety dressed with 10 lb. super (see No. 2 experiment)	Bud-formation promising heavy crop for 1928 season.
Rome Beauty (12)	{ 3 lb. super 1 lb. sulphate ammonia 1 lb. sulphate potash }	9	15½	24½	6½	9	15½	Trees much improved; buds extra plump	Trees further improved; foliage well retained in autumn; extension of branches 6 in. to 10 in., compared with 2 in. on unmanured area.
Delicious (15)	{ 3 lb. super 2 lb. dried blood }	20	9	29	8	6	14	Trees much distressed by droughty conditions; results could be estimated only by comparing increase in yield over unmanured area	Fructing-wood highly developed on manured trees; no increase in leaders. Fully developed fruit-buds throughout. Crop seriously depleted by late frost.
Dougherty (15)	{ 3 lb. super 2 lb. sulphate potash }	8	8	16	6½	5½	11½	Trees receiving 1½ lb. manure rather smaller tree than those receiving 5 lb. owing to nature of ground.	Bud-development more pronounced in manured area.
Cox's Orange (15)	5 lb. super	8½	6	14½	6	2½	8½	No difference in general appearance of trees compared with unmanured area. Consider dry conditions nullified experiment	Extra development of foliage on manured area very pronounced during early summer.
Sturmer (15)	5 lb. Nauru phosphate	16½	13½	30	12	9	21	Unmanured section foliage weak when compared with manured area	
Total yields		107½	107	214½	68½	73½	141½		

Totals of 102 trees treated = approximately ½ acre, at 134 trees to the acre.

Total increased yield from manured trees over unmanured, 73 bushels, equivalent to an increase of 91 bushels per acre

Experiment No. 2. 10 lb. Manure to each Tree.

Variety treated and Number of Trees.	Manure applied to each Tree.	Yield in Bushels by Manured Trees.		Yield in Bushels by Unmanured Trees.		Remarks, 1926 Season.	Remarks, 1927 Season.
		1926.	1927.	1926.	1927.		
		Total.	Total.	Total.	Total.		
Ballarat Seedling (15) ..	10 lb. Nauru phosphate ..	22	13½	35½	17½	34½	..
Dunn's (15) ..	10 lb. super ..	14	36	50	12	24½	Good crop gathered from both manured and unmanured trees
Rome Beauty (12)	{ 8 lb. super .. 1 lb. nitrate soda .. 1 lb. sulphate potash ..	{ 12	{ 12½	{ 24½	{ 6½	{ 15½	Heavy crop of small, badly developed fruit. Buds showing well for next season
Delicious (15) ..	{ 6 lb. super .. 4 lb. sulphate potash ..	{ 12	{ 14	{ 26	{ 8	{ 14	..
Dougherty (15)	{ 6 lb. super .. 2 lb. sulphate ammonia .. 2 lb. sulphate potash ..	{ 9	{ 9½	{ 18½	{ 6½	{ 11½	Foliage retained much later than usual
Cox's Orange (15)	{ 6 lb. super .. 4 lb. dried blood ..	{ 14	{ 8	{ 22	{ 6	{ 8½	..
Sturmer (15) ..	{ 6 lb. super .. 2 lb. nitrate soda .. 2 lb. sulphate potash ..	{ 17	{ 16½	{ 33½	{ 12	{ 21	No extension of leaders. Heavy crop harvested on all sections; fruit small
Total yields ..	..	100	110½	210½	68½	73½	141½

Total 102 trees treated = ½ acre, at 134 trees to the acre.

Total increased yield from manured trees over unmanured, 61 bushels, equivalent to approximately 80 bushels per acre.

Experiment No. 3 (Special).

Variety treated and Number of Trees.	Manure used.	Purpose of Experiment.	Results, 1926	Results, 1927.
Rome Beauty (1)	5 lb. nitrate soda	To stimulate growth in very debilitated and stagnant tree	Negative. Attributed to insufficient rainfall	Foliage renewed to dense condition; general extension of all growing terminals, also maximum development of fruit-buds for 1928 season.
Delicious (1) ..	5 lb sulphate potash	To prevent or reduce heavy drop of fruit generally experienced in this variety, by increasing resistance to effects of spray, or hardening of plant-tissues; and to increase colour	Negative. Tree showing symptoms of potash poisoning; recovered normal condition or appearance in late autumn	Negative. Depletion of crop by late frosts, on a par with other trees of this variety. No benefit could be attributed to manuring.

to remain and to look for more pronounced results at the end of the second season (1926-27). Where remarks are made in tabulated form the results have been regarded as outstanding and conclusive.

SUMMARY.

(1) Where manures have been applied the total increases in yield show that manuring in almost every proportion would assure a profitable increase over expenditure compared with no manure.

(2) Nitrate of soda, used at 5 lb. to the individual tree, afforded the only instance in which both the results looked for were attained—namely, renewal of young growing terminals combined with increase in crop, thus making its continued use appear the most desirable application.

(3) Fruiting-wood and bud-development were considerably increased in every instance, probably due to prolonged retention of foliage in the autumn.

(4) A successive heavy crop was secured in the Sturmer trees with both formulas used, a feature which had not been previously attained in the history of the orchard.

(5) The increased quantities of fertilizers used in Experiment No. 2 do not seem justified by results.

(6) The results suggest that greater contrasts in quantities and proportions of manures would show more pronounced and more valuable results in future experiments which may be undertaken by growers for a similar purpose.

The thanks of the Department are due to Mr. T. H. Torode for his close co-operation and trouble taken in recording the weight of crops harvested from the trees under test. The manures for the experiment were generously donated by Messrs. Wright, Stephenson, and Co., Ltd., on their being approached by the fruitgrowers.

WINTON EXPERIMENTAL AND DEMONSTRATION FARM.

NOTES ON OPERATIONS, SEASON 1926-27.

R. M. MCGILLIVRAY, F.L.S., Instructor in Agriculture, Invercargill.

DURING the year under review the Winton Experimental Area was vested in the Winton Agricultural and Pastoral Association, and the management taken over by a committee, of which the writer is *ex officio* chairman. The name of the establishment was at the same time altered as shown in the title above.

The farm has had a very successful year, and it is pleasing to be able to record a most satisfactory attendance of farmers throughout the period. As usual, the pasture blocks and their treatment were the principal pivot of attraction. The manurial trials of swedes, chou moellier, &c., attracted the attention of many, as also did the growing of smother-crops for checking Californian thistle.

During the period a dwellinghouse for the Overseer was erected, and the farm buildings were shifted to a more convenient site. The plans for a cow-byre are now in hand, and it is proposed to establish a dairy herd in the coming spring and to go fully into the dairying position, including the possibilities of stall-feeding during the winter and early spring. Such an investigation would be of great importance, and its outcome should have an important bearing on future dairying practice in Southland.

PASTURE INVESTIGATIONS.

Block 1, sown in October, 1925, is a pasture in which meadow-fescue took the place of perennial rye-grass. There are three separate subdivisions, in which the fescue was included in the mixture at the rate of 8 lb., 16 lb., and 24 lb. per acre respectively. This pasture has proved a great success. The mixture in which the fescue was included at the rate of 16 lb. per acre appears to be better than the sowings of 8 lb. and 24 lb. Cocksfoot sown at the rate of 8 lb. per acre has established extremely well. Top-dressing was carried out in alternate strips of high-grade super and Seychelles guano, at the rate of 3 cwt. per acre. The super plots were slightly earlier in growth, but by the middle of November all plots were even, and the clover-plants were making a strong growth under both treatments. In the late autumn the Seychelles plots were to some extent closer eaten than were those where super had been applied.

In Block 2, laid down at the same time as Block 1, meadow-fescue was not included, its place in the mixture being taken by perennial rye-grass sown in three subdivisions at the rate of 8 lb., 16 lb., and 24 lb. per acre. At the present time the 24 lb. subdivision is slightly better than the other two. Cocksfoot was included in the mixture at the rate of 8 lb. per acre, but its establishment when in competition with perennial rye-grass has been slow. The depressing effect of rye-grass on cocksfoot-establishment under certain conditions is well known, and this is a striking demonstration of the fact. This pasture is quite a good one, with rye-grass easily dominant even where only 8 lb. per

acre of it was sown. The top-dressing was the same as that recorded for Block 1, and results were also similar.

Block 3: A special report on this area was published in the *Journal* for March last under the title of "Liming and Top-dressing of Pasture at Winton Experimental Farm: Results for 1926."

Block 4 was laid down in 1920, and has been top-dressed with basic slag since 1924. The pasture is in extremely good heart, and is becoming widely known owing to its flourishing condition and high carrying-capacity. It is a pasture that has successfully carried stud hoggets through the past three winters without the aid of turnips or other feed. All pasture-plants sown in 1920 are still to be found, with the exception of Lotus major, which seems to have been crowded out.

Block 6 is a perennial rye-grass and white clover pasture sown in 1920. It was top-dressed in 1924 with Nauru rock phosphate, but without apparent results. In the autumn of 1926 it was noticed that the turf was opening up and failing badly. One half was therefore top-dressed with high-grade super and the other half with basic slag. The improvement in condition shown in the spring of 1926 was very remarkable. In the case of both fertilizers the pasture constituents made a fresh growth and clover appeared in abundance. Two acres of this block also received 30 per cent. potash salts, at 1 cwt. per acre, across both the super and slag plots. An earlier growth of clover was apparent in the spring, also a more prolific clover-growth in the late autumn, but no marked preference for the potash area was shown by the sheep.

Part of the old brown-top pasture on Block 15 was top-dressed with carbonate of lime, 1 ton, and superphosphate, 3 cwt., per acre in June, 1925, in order to obtain information as to results possible on such a sward, which, so far as could be seen, consisted only of brown-top and catsear. Very little difference was seen until about October, 1926, when white clover began to show up all over the top-dressed portion. It was also noticed that the stock grazed the top-dressed portion closely, and right up till May it provided good pasturage that was kept well eaten down.

Two other permanent-pasture blocks were laid down in October last, and are doing well. In one block an unlimed strip of land runs right across the field, and this affords a striking demonstration of the value of lime in Southland. On each side the pasture is strong and healthy, while on the unlimed strip it is weak, and weeds such as sorrel and spurrey are present in abundance.

At the Winton Farm top-dressing, harrowing, and mowing are regarded as vital operations in pasture management. The harrowing of pasture blocks is undertaken whenever necessary. Chain harrows are used for distributing the animal-droppings, but these are not drastic enough when it comes to work such as the renovation of old turf. No operation, however, is of more importance than mowing, and much of the success of the farm pastures can be attributed to the fact that rank growth is prevented.

SMOTHER-CROPPING FOR CALIFORNIAN THISTLE.

A field in which Californian thistles had a very strong hold was taken in hand in the autumn of 1926 and ploughed and sown, one part

in oats and winter vetches and the other in oats and *Lathyrus tingitanus*, for the purpose of acting as a smother-crop. The crop was sown in March, and came away so well that it had to be eaten off with sheep in May, and again in August and September. It was then allowed to stand for a seed crop. The winter vetches made a very heavy growth, but not to be compared in weight to that of the *Lathyrus*, which brought about a complete smother of the thistle. Very few thistles appeared, even in the portion sown in vetches. On examination it was found that the underground stems had a shrunken appearance and were less than one-third of their normal size.



FIG. 1. FIELD BADLY INFESTED WITH CALIFORNIAN THISTLE PRIOR TO GROWING OF SMOTHER-CROPS.

The field has again been sown in oats and vetches in an endeavour to completely clear the area of thistle during the coming season. Another area of 5 acres has been sown in *Lathyrus tingitanus*, so that a supply of seed of this vigorous-growing legume may be obtained for future operations.

CHOU MOELLIER, THOUSAND HEADED KALE, AND CRIMSON KING
SWEDES.

An area of 10 acres (Block 13) was devoted to manurial tests of chou moellier, thousand-headed kale, and Crimson King swedes. An additional acre was also sown in swedes, the seed for half of which was treated by M. J. C. Neill, Field Mycologist, in connection with the control of dry-rot. The bulbs were examined on the last day of April. Considerable infection was found in the untreated-seed area, but only one bulb was found infected on the plot sown with treated seed. Moreover, this infected one was found in the drill next the untreated seed and in close proximity to a patch of dry-rotted bulbs.

The manurial trial, which proved of special interest to many visitors, was laid out as follows, all amounts being at per-acre rate: (1) Super, 2 cwt.; (2) super, 2 cwt., and blood, 1 cwt.; (3) super, 2 cwt., and 30-per-cent. potash, 1 cwt.; (4) super, 2 cwt., 30-per-cent. potash, 1 cwt., and blood, 1 cwt.

Results from the different treatments were as follows, the figures given representing yield per acre: Chou moellier—(1) 20.0 tons, (2) 19.3 tons, (3) 20.7 tons, (4) 22.0 tons; thousand-headed kale—(1) 14.6 tons, (2) 12.5 tons, (3) 16.3 tons, (4) 12.2 tons; swedes—(1) 31.5 tons, (2) 33.2 tons, (3) 35.6 tons, (4) 31.8 tons.



FIG. 2 SHEEP ON SWEDE TRIAL CROP.

SWEDE MANURIAL TRIAL.

A 5-acre manurial trial of swedes proved of considerable interest. The fertilizers were tested at the rate of 2 cwt. and $2\frac{1}{2}$ cwt. per acre. In the case of the mixtures, half-and-half of each fertilizer was used. Results are shown in the following table:—

Fertilizer.	Yield per Acre		Increase in Yield per Acre.
	Fertilizer, 2½ Cwt.	Fertilizer, 2 Cwt.	
	Tons.	Tons.	Tons.
Superphosphate	35.23	27.27	7.96
Super and Walpole Island phosphate	33.26	31.15	2.11
Super and basic slag	42.68	36.43	6.25
Super	39.50	27.73	11.77
Super and Seychelles phosphate	41.95	32.43	9.52
Super and Ephos phosphate	42.70	40.31	2.45
Super	39.15	24.88	14.27
Super and Nauru phosphate	38.49	33.60	4.89

Mr. T. Pattinson, Manager of the farm, carried out his work in a most efficient manner, and much of the year's success is due to his care and close attention to details.

PACKING OF PEARS FOR EXPORT.

J. A. CAMPBELL, Director of the Horticulture Division, Wellington.

ALTHOUGH up to the present pears have not been exported from New Zealand in quantities comparable with apples, even relatively to the amount produced, sufficient has been done in this respect to demonstrate two important facts. The first is that under normal conditions pears—particularly the better-class varieties arriving on the English market in a sound condition—can be practically relied upon to return to the shipper a very satisfactory profit. The second is that, generally speaking, we shall have to exercise very much greater care before we can hope to land the major portion of our shipments not in indifferent to passable order, but in that really good condition in which they are required by the market and which the excellence of our fruit fully warrants.

During the past eight years pears have been exported from New Zealand in the following quantities :—

	Crates		Crates.
1920	.. 1,009	1924	.. 1,432
1921	.. 3,112	1925	.. 3,516
1922	.. 8,148	1926	.. 9,449
1923	.. 313	1927	.. 22,075

The past season's shipments were the largest that have yet gone forward, and although the class of fruit shipped was of high quality, embracing the leading varieties, and secured to shippers really good average returns, we by no means escaped criticism from the London end. Some of this criticism was extremely caustic, and rightly so, if alleged shortcomings really existed, such as extremely loose packing, entire absence of wood-wool, stem-punctures, rot, &c. Unflattering comparisons were made between our methods of handling pears and those employed by South African growers, or in comparison with our own handling of apples. Why at this stage we should be so much at fault is difficult to understand.

The success achieved by South Africa has been fully appreciated. That country is much nearer to the British market than is New Zealand; nevertheless, growers there find it expedient in their own interests to exercise the greatest care possible in the handling and packing of their pears—a care far greater than is observed in this country in relation to a service infinitely more trying to the fruit. As much information as possible relative to the methods employed in South Africa has been secured and made available to New Zealand pear-growers. Even used South African pear-trays have been secured from England, and trays fashioned on the same plan made available for use here. Therefore, as far as the package is concerned, we are as well situated as South Africa. The trouble, however, lies in the fact that we are not putting the package and the wood-wool packing used in connection with it to the same intelligent use as the South Africans, nor are we handling our fruit as carefully.

Each pear-grower should secure a supply of timber that will enable him to construct trays 2½ in., 2¾ in., or 3 in. deep, or to arrange

for all trays to be $2\frac{1}{2}$ in. deep, and at the same time have a supply of cleats similar to those used on the lids of apple-cases. By placing one or more of such cleats under either end of the lid the tray can be made to accommodate fruit of different sizes.

Whether timber for the construction of trays of different depths is ordered, or whether cleats are to be used for increasing the depth of trays, is a matter for the individual grower to decide; but it is essential that the tray should accommodate the pear with something over $\frac{1}{4}$ in. to spare, so as to allow for an adequate cushion of wood-wool. In the latter connection, again, our methods are faulty as compared with those of our friends of South Africa. We certainly use wood-wool—at least, we are supposed to do so. Nevertheless, reports to hand from London regarding the pears forwarded by the "Ionic" in the past season state that, in some instances at least, the pears were resting on the bare board, not a vestige of packing-material being present. Notwithstanding this charge, wood-wool is generally used, but more often than not in such quantities as to be practically useless for the purpose intended—namely, to tighten the pack and provide an adequate protective cushion for the fruit. South African growers are evidently more lavish in the use of this material, going to the extent of providing practically a padded pocket for each pear—and why should they not? It is surely a short-sighted policy on the part of a grower who has gone to the trouble and expense of preparing a comparatively costly package, and has placed in that package fruit of first-class quality, which, if in good condition when offered for sale, is likely to realize a handsome price, to jeopardize the whole position in endeavouring to economize in such an inexpensive material as wood-wool.

There is also the question of handling. The examination of pear consignments at Wellington before shipment, supported by reports from London, indicates that the item of stem-punctures plays a very important part in the condition of the fruit. It is essential that growers should realize this, and do everything possible by way of careful handling to guard against the trouble in future.

Pears are put up in what may be termed fancy packages, each tray being complete in itself and containing one layer of fruit only. The buyer, in view of the get-up, small quantity of fruit, and price, is justified in expecting something specially good, and it is easy to understand his dissatisfaction when he finds that several rotten pears form part of the limited number the tray originally contained. On the other hand, if this were evident before the purchase was made, the reduction in price would no doubt represent a fairly heavy penalty on the grower for his carelessness.

POINTS SUMMARIZED.

Summarized, the points to be observed in connection with the export of pears are as follows:—

- (1) Select only good-quality pears of the popular varieties that will carry well.
- (2) Pick and handle the fruit carefully, remembering that a high-priced article is being dealt with.
- (3) Provide trays that will comfortably accommodate the fruit of different sizes, allowing room for an adequate amount of wood-wool

packing. Do not attempt to pack large pears in shallow trays, or try to make small pears fit a deep tray by packing them on their ends. Packs of the latter kind invariably loosen up and rattle.

(4) Size the fruit carefully, packing only pears of the same size in each tray forming the package.

(5) Pack all pears on their sides, avoiding overlapping as much as possible. Fill all vacant spaces with wood-wool, place a good layer over the fruit, and press down firmly to consolidate it before lidding.

Full particulars regarding the construction of trays, building up of packages, wiring, labelling, and marking were given in the 1927 season's export regulations published in the *Journal* for January last.

WAX COATING OF EXPORT CHEESE.

SOME FURTHER INFORMATION.

W. E. GWILLIM, Assistant Director of the Dairy Division, Wellington

SEVERAL prominent dairy companies in the past season have adopted the method of coating their export cheese with paraffin-wax. The object apparently was to serve the double purpose of meeting the requirements of those buyers who prefer wax-coated cheese, and to save a certain amount of the loss in weight from shrinkage that occurs with cheese in general. Specially designed plant has been installed at the factories, which enables the waxing to be applied expeditiously and with very little extra labour. The enterprise is commendable, and has aroused considerable interest among cheesemakers.

It may be recalled that the subject of wax-coating cheese was discussed in the *Journal* for January, 1925. The merits and limitations of the method were pointed out, and the results given of some experiments carried out by the Dairy Division. These may be summarized as follows: (1) Only a section of the trade favoured wax coating; (2) wax-coated cheese matured better than unwaxed; (3) the appearance of the cheese was more pleasing in so far as there was less mould-growth; and (4) the saving in weight effected by wax coating was about 1 per cent. between here and arrival of the cheese in Britain. It has since been observed that wax coating affords cheese extra protection against dampness due to condensation of moisture in the air circulated in the cool chambers of ships during the voyage to the overseas market.

According to reports received from our officers in Britain regarding the shipments of wax-coated cheese received this season, the cheese arrived in good condition and occasioned no adverse comments from the selling-agents. The wax had been well applied, except that in a few of the earlier shipments the coating was a little thicker than desirable. Buyers generally displayed no special interest in regard to the coating, the large majority appearing indifferent as to whether the cheese were waxed or not, and it is thought that much was sold without the buyers noticing the wax coating.

Inquiry of merchants handling the cheese as to the advantages likely to accrue to the producer by general adoption of the method

elicited information to the effect that the absence of wax coating was not a selling-point against New Zealand cheese—in fact, a large number of the trade prefer New Zealand cheese in its usual unwaxed condition; also, that there is some prejudice against wax-coated cheese. It was considered that the only gain which could be safely counted upon would be the saving effected in shrinkage during the transit of the cheese from New Zealand. This view was based on experience in the storage of Canadian cheese, which had demonstrated that the wax-coated article lost less in weight than the unwaxed. Each season it is usual to hold a certain quantity of Canadian cheese for several months for maturing purposes. The cheese selected is of good-keeping quality, and is waxed in Canada to the order of the buyer. The consensus of opinion was that as New Zealand cheese is usually sold promptly after arrival the necessity for wax coating, from the seller's point of view, does not arise.

It may be concluded from what our officers have reported that the general adoption of wax coating would be inadvisable, but in cases where the selling-agent or buyer desires wax-coated cheese for his trade the method is worth undertaking. In any case, wax should not be applied to other than well-made, good-bodied cheese.

PRODUCTION PER CAPITA IN THE DAIRY INDUSTRY.

"MEMBERS of the conference may be interested in an indication of the production, on a *per capita* basis, of those persons engaged on farms principally devoted to dairying," remarked Mr. W. M. Singleton at the recent annual conference of the National Dairy Association. "Converting the whole of our dairy-products to the basis of butterfat equivalent, the figures show that the production of butterfat per person so employed was as follows —

Year	Butterfat.	Percentage Increase over 1920-21.	Year	Butterfat	Percentage Increase over 1920-21.
	lb.			lb.	
1920-21 ..	2,513	..	1923-24 ..	2,853	13.50
1921-22 ..	2,789	10.96	1924-25 ..	2,997	19.24
1922-23 ..	2,761	9.84	1925-26 ..	3,228	22.12

"These figures suggest that there is no general disposition among the people engaged in the production of milk and cream to follow the 'ca' canny' or 'go-slow' policy. The increase *per capita* has doubtless been favourably influenced by the extension of milking by machinery. It has also been similarly influenced by the improvement in yield of the average dairy cow.

"The following figures, relating to the manufacturing phase, show an increasing output per employee in dairy factories:—

Year.	Per Capita Out-put of Butterfat.	Percentage Increase over 1920-21.	Year.	Per Capita Out-put of Butterfat.	Percentage Increase over 1920-21.
	lb.			lb.	
1920-21 ..	45,736	..	1923-24 ..	56,044	22.5
1921-22 ..	51,466	12.5	1924-25 ..	58,094	27.0
1922-23 ..	56,831	24.2	1925-26 ..	63,991	39.9

SEASONAL NOTES.

THE FARM.

FEEDING OF LIVE-STOCK.

SEPTEMBER is frequently a particularly difficult month for the grass-farmer. If the weather is cold the spring growth of grass may be greatly delayed, and early-calved cows and newly-lambd ewes may do badly for want of proper feed. The provision of supplementary feed and the management of grassland, so that normally sufficient feed is available for the early spring, is an extremely important factor in successful grass-farming. The methods for attaining this end will naturally vary considerably in different localities and with the system of farm-management adopted.

In North Island dairying districts the modern tendency in grass-farming is in the direction of close subdivision, heavy top-dressing, and the provision of supplementary feed for periods of grass shortage by means of hay and ensilage saved from the surplus summer production of grass. Cows in milk require feed rich in protein—*i.e.*, having generally a narrow nutritive ratio—such as young pasture-grass. In order to provide sufficient protein-rich feed for the early spring it is usually necessary to save a considerable amount of the winter growth of grass, by almost completely maintaining the cows during their dry period on hay, ensilage, and roots. Grass can be most successfully saved for the spring when the pastures are top-dressed in the early winter and consist very largely of perennial rye-grass.

However, it frequently happens that when the grass-growth is late any grass that has been saved during the winter is finished before the spring growth starts, and consequently production falls in September. To provide against this it is always wise to keep the best hay available for spring feeding. Lucerne or clover hay is admirable for milk-production; but even where these are not available the best pasture hay containing the most clover should be kept for the spring. When grass is scarce, and heavy pasture hay, ensilage, and root feeding is being given to milking-cows in September, it might possibly be profitable, in certain cases, to feed protein-rich concentrates to the cows until grass-growth starts properly.

For the mixed farmer raising fat lambs two courses are open to provide for feed shortages in the early spring—the provision of grass supplementary crops and the regulation of stocking. On South Island mixed arable farms fodder crops figure largely in the cropping system, and in normal years the breeding-flock is carried through the winter on turnips and green cereals until the spring growth of grass commences. Although, owing to the low winter temperatures, there is little winter grass-growth from permanent pasture that can be made available for early spring grazing, the careful spelling of all new short-rotation and temporary pastures usually conserves sufficient feed in years when the ordinary grass-growth is delayed.

On North and South Island permanent-grass farms where fat-lamb raising is an important industry the secret of success lies generally in understocking during the winter with breeding-ewes, and in the

later regulation of stocking with dry cattle or sheep, depending on the grass-growth. On many North Island fat-lamb-raising grass-farms the rearing of dairy heifers is becoming an important industry, and this class of cattle allows of better stock manipulation than the buying-in of dry sheep or cattle for short periods. Bought in as calves, wintered, mated with a dairy bull, and sold later the following winter as in-calf heifers, they can be profitably used to keep the pastures short for the ewes and lambs, and also repay the feeding of hay in the winter. In this way some of the surplus summer grass can be profitably used for winter feeding, and this allows more grass to be available for the breeding-ewes in the winter and early spring.

CROP-PRODUCTION.

Land for root and forage crops will normally be ploughed in September, after the sowing of spring cereals is finished. In the drier districts, when such crops follow a cereal, winter ploughing is preferable so as to allow easy penetration of the winter rains. Ploughing in September will usually be the case when grassland is broken up, or where roots follow a green-feed cereal crop sown on a stubble. In the case of grassland the skim-coulter could be more often used in ploughing than it is at present. Its use allows of the formation of a firm seed-bed, and if wet weather follows ploughing, preventing working of the land, there is little or no grass-growth between the furrow slices. Such grass-growth is particularly noticeable in many parts of the North Island, and is often extremely troublesome when the ground is being worked down.

Land for potatoes that has been skimmed in the autumn should be cross-ploughed in readiness for working up and planting in October.

As the autumn-sown cereals are fed off they should be harrowed, so as to aerate the surface and scatter the clods which have been broken up by the winter frosts.

Except in the far South, all spring cereals and cereal and legume mixtures for hay should be got in by the end of August. If heavy rains are likely in September it is often worth while to delay the sowing of barley till the end of that month or early October in order to avoid the danger of having the crop drowned out.

Cereals sown in the spring require a heavier seeding than when sown in the autumn, because, when autumn-sown, tillering takes place to a greater extent than is the case with spring crops. Also with cereals for threshing, a light seeding in the spring will give rise to a number of late tillers, and consequently a high proportion of shrivelled grain. The average seeding for spring cereals will be about $2\frac{1}{2}$ bushels to the acre, but the amount will vary from 2 to 3 bushels, depending on the cereal and the local conditions. Oats and tares are often used as a hay crop in arable-farming districts, and can be depended on to give a heavy yield of very nutritious hay. The average seeding is about 2 bushels of Algerian oats and 1 bushel of tares.

PASTURE-MANAGEMENT.

All dairying pastures will benefit from thorough chain and tripod harrowing during September. Especially is this the case with pastures on which winter supplementary feeding has been carried out.

The organic matter of the spread droppings has a wonderfully stimulating effect on both clovers and grasses, and frequent chain-harrowing is essential for the maintenance of a good even turf. In harrowing old pastures it is not sufficient to spread the droppings only; the tripods should be heavy enough to slightly tear the surface and allow the aeration of the surface layer of the soil.

All spring top-dressing should be finished by the end of September. Superphosphate is the most suitable fertilizer to apply at this period of the year. Although top-dressing is now quite general in the North Island, there is no doubt that increased production could be obtained on many farms by a more extensive use of phosphatic fertilizers. It is very difficult to estimate the actual increase in production brought about by top-dressing, because other factors, such as closer subdivision and better live-stock, have practically always been closely associated with any progressive movement in agriculture in any given district. Top-dressing, however, was one of the chief means by which much of the Waikato land was raised in fertility, and it is interesting to consider the following figures relating to the agriculture of Waikato County covering a period of twenty years. In 1905 top-dressing was just beginning to be a recognized practice, while in 1925 the practice was general.

			1905.	1925.
Horses	(Number)	4,000	5,750	
Dairy cows	"	8,750	42,300	
Other cattle	"	17,000	32,750	
Sheep	"	28,000	43,750	
Cereals	(Acres)	3,300	1,100	
Fodder crops	"	8,300	8,000	
Sown grass	"	107,250	173,250	

In 1905 the carrying-capacity of the grassland was slightly over the equivalent of $1\frac{1}{2}$ sheep per acre, and in 1925 it was equivalent to 3 sheep per acre. As will be seen, this increase in stocking was not accompanied by a proportionate increase in fodder crops; although the area under grass was nearly 75 per cent. greater in 1925, the area under supplementary crops had declined slightly.

—P. W. Smallfield, B.Ag., Instructor in Agriculture, Ruakura.

THE ORCHARD.

SPRING PREPARATIONS.

By the time these notes appear all pruning operations in the orchard should have been completed. If not, it is advisable to push on with the work as quickly as possible, giving time for a general clean-up before the trees start into growth for the coming season and spraying operations commence. Growers usually find themselves pushed for time at this season, probably on account of wet weather, &c., and consequently something is left undone. It may be that the prunings are left scattered about the orchard instead of being collected and burnt, or that the spray-pump has not received the necessary overhaul in preparation for its continual use during the spring and summer months. Nothing

is better calculated to test the temper of a grower than a spraying outfit continually going wrong, or, when cultivating the orchard, to be always stopping the implements to remove large prunings left lying about. Consequently it is well to be on time with all the routine work, and even if slightly before time there are always plenty of odd jobs to keep one fully occupied.

SPRAYING OPERATIONS.

It is recognized by all commercial orchardists that the early sprays up to the blossoming-period are of vital importance for the control of fungoid diseases, and although there is a tendency in some districts to delay the first spray as late as possible this practice is not recommended—anyhow until such time as we have positive proof that the early or green-tip spray is of no value and can be dispensed with. Spores of fungus diseases as well as insect pests are lurking under bud scales, rough bark, dead twigs, &c., and are only awaiting a favourable opportunity to commence their activities. Fruit-trees at this time of the year can stand a much stronger spray than later, therefore a good application early, when the trees are just starting into growth, often prevents trouble as the season advances.

Just when to start spraying must be determined by the orchardists in the different districts, there being, of course, variations from Auckland to Bluff. The most important point is to be ready with all appliances in good order, so that no time is lost when spraying actually commences. Thoroughness is the keynote to success, and every care should be taken that all exposed surfaces are covered with the spray, since any portion missed may mean an open port of entry for disease. Many growers, knowing that spraying is a more or less disagreeable job, are apt to rush the work, and they then sometimes wonder why the results are not as good as those of the next-door neighbour who sprayed with the same mixture at the same strength. Rather aim at spraying 5 acres per day properly than 10 acres just to get the work over. Weather conditions also play an important part in spraying operations. Should rain follow directly after spraying, it is advisable to repeat the operation, the main object being to keep a thin film of spray over every part of the tree.

Spraying programmes vary with the different districts and according to climatic conditions; consequently it is almost impossible to lay down any hard-and-fast rule suitable for the whole. If a grower has been successful in previous seasons with a certain programme he may be advised to adhere to it. On the other hand, if he is not getting the results desired the advice of the Orchard Instructor for the district should be sought.

The use of red oil at the dormant or bud-movement period is a very debatable point with growers, many claiming that the results obtained do not justify the use of such an expensive spray every season. However this may be, there is no doubt that it is a very beneficial spray, both for keeping insect pests in check and for the general good of the tree. Consequently it should be used at least periodically, at strength 1-15-25, according to advancement of the buds.

Many growers prefer a good bordeaux spray at the green-tip stage, especially on varieties such as Delicious and Sturmer. As there is

no fear of russetting at this period, bordeaux at strength 6-4-50 can be used with safety. If lime-sulphur is preferred, 1-20 to 1-25 at the same period should be used. Owing to the chance of russetting with bordeaux it is advisable to switch over to lime-sulphur after the first spray, using a 1-40 solution at the open-cluster period.

Bordeaux is recommended for the control of black-spot on pears—an application of 6-4-50 at the green-tip stage, followed by 3-4-50 from the open-cluster to the pink period. An exception may be made with the Winter Cole, P. Barry, and Josephine varieties, using 1-60 lime-sulphur at the pink stage in preference to bordeaux.

For the control of leaf-curl, shot-hole, &c., on stone-fruits a thorough application of bordeaux at strength 6-4-50 when the buds begin to swell is recommended. This should be followed by either bordeaux, 3-4-40, or lime-sulphur, 1-50, at the pink stage. It is claimed by many that lime-sulphur at the pink stage is a great factor in the control of brown-rot, and consequently it should not be neglected, as this disease probably takes more toll than any other trouble stone-fruits are subject to.

CULTIVATION.

Early cultivation of the orchard is as necessary and valuable as the early spraying, and if the annual ploughing has not already been done it is advisable to attend to it as soon as the soil is in a fit condition. Where late autumn ploughing was done, with the intention of cross-ploughing in the spring, the operation may be deferred for a short time, but it is essential that the work should be completed before the trees start into growth and spraying operations commence. Cultivation round the trees, where it is impossible to work with the plough, is sadly neglected in many orchards. Trees dug or hoed round at this time of the year, turning under all sods left by the plough, dead leaves, rubbish, &c., will require very little further attention during the season, as the disks or harrows will keep the soil fairly clean. Turn in cover-crops about this time, giving the green material every chance to rot before the dry weather sets in.

MANURING.

It is only during the past few seasons that systematic manuring has been carried out in many orchards. Growers are realizing that it is impossible to get the best crops every season without returning to the soil plant-food taken out during the growing-period of the tree. Probably the latter part of August or the beginning of September is the best time to apply manure in the orchard, this allowing the rains at that period to take it down into the soil. Each orchardist should find out what are the requirements of his orchard as far as manure is concerned, and apply it accordingly. By the growth of the tree, leaf-surface, fruitfulness, &c., a good idea can be formed as to whether phosphates, nitrogen, or potash is needed. Liming is also usually a beneficial adjunct to manure, and the application of 1 ton per acre every few seasons should not only tend to improve the soil, but make available much plant-food lying dormant.

—G. Stralford, Orchard Instructor, Motueka.

Citrus-culture.

Planting.—Where new citrus plantations are being set out or replacements made in existing areas, planting should be done during August and September. It is true that citrus-trees may be transplanted up to late October, but much better establishment is secured by planting in early spring. The main essential factors of planting are that the soil shall be in good condition to work freely—not sticky. Trees should be planted firmly with the roots well spread, rather than in the hard, compacted, balled condition in which they are often received. Though the soil must be firmed round the roots, the surface soil should be left loose. The plants should be supported by a strong stake—inclined towards the prevailing wind—if the situation is at all exposed. The stake—not the tree—should be bound with sacking or like material to prevent chafe. Long, extended, or unshapely growth should be cut back so as to shape the tree and restore balance between top and roots. Any manures or fertilizers applied to the land at planting-time should be well mixed with the soil, not placed in direct contact with the roots. Plants with a stem of 12 in. to 15 in. are to be preferred, having the union of variety with stock about 6 in. above soil-level. All trees of low-branching habit should be pruned to a single stem, rather than allow the first branches to form near the ground. Varieties recommended for planting in this country are as follows:—

Lemons—Eureka and Lisbon.

Limes—Tahiti.

Sweet Oranges—Navelencia and Valencia;
Late.

Preserving Oranges—Poorman.

Mandarins—Scarlet and Thorny.

Pomelo—Marsh Seedless

Pruning.—This season of the year, just prior to spring growth, is an appropriate time for generally shaping the tree by cutting back extended bare wood, undesirable wood, and all misplaced inside wood. All cuts made should be to a good bud and the cut surface painted with coal-tar.

Cultivation.—Ploughing should be done to turn in green crops which may have been grown for this purpose, or weeds which are best disposed of at this period by being turned under. Even though the soil may be in clean condition, ploughing at this time of the year is beneficial, breaking up the compacted state of the soil and permitting aeration. The area near the trees which cannot be ploughed or cultivated with horse-implements should be dug with the spade, in order that the ground may be dealt with by the hoe later. Unless the land is dug over now fibrous roots become so dense as to make it impossible to more than scratch the surface later. On the other hand, by digging the soil now, when fibrous roots are least necessary, an open soil condition is secured which allows several inches of surface soil to be kept in good tilth during the summer. When ploughing to work in a heavy dressing of animal manure, it is better that the manure should be spread along the furrows as ploughing is being done. Where artificial fertilizers are to be used they should be spread evenly over the whole area, rather than immediately near the trees; they may be ploughed in or worked in with the first cultivation. For bearing trees 4 lb. blood-and-bone, 1 lb. superphosphate, and $\frac{1}{2}$ lb. sulphate of potash per tree is a good dressing now, with two dressings of $\frac{1}{4}$ lb. nitrate of

soda each later in the growing season. Half these quantities should suffice for trees up to five years old, while a proportionately heavier dressing should be given to very old or heavy-fruited trees.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

THE SITTING HEN.

WHEN hens are used for hatching purposes the aim should be to make the conditions as natural as possible, at the same time having the hen under control. It is always best to have a boarded floor to a coop, unless, of course, the coop is under cover. In the latter case the nest should be made on the ground. When a coop in the open is used—whether with or without a floor—it should be raised inside with fine earth about 3 in. above ground-level. This will help to keep the hen and her brood high and dry when wet-weather conditions prevail. The nest should be formed in the earth in saucer shape, and made in such a way that the eggs will not roll out, nor roll on top of each other. The bottom should be more or less flat, in order to allow the hen the necessary room to turn the eggs, which she does several times a day.

Nothing but a little hay should come between the eggs and the earth, and if there is some moisture in the earth so much the better. The common trouble, when the natural mother is being used, of chicks failing to hatch when fully developed is invariably due to want of moisture, especially during the hot season of the year. In an endeavour to overcome this trouble some people spray the eggs with warm water towards the end of the incubation period, but this does not always have the desired effect. A better plan when it is considered that the air is dried down too far is to lift the hay, or whatever nesting-material is used, and slightly moisten the earth. In this way the heat of the bird's body will draw the moisture to the eggs, and soften the membrane under the shell, thereby greatly assisting the chick to get out of its shell.

Do not let lice drive the sitting hen from her nest—a common occurrence when the eggs are on the point of pipping. Give the hen a good dusting with insect-powder when being set, and again before the chicks hatch, care being taken that the powder reaches the skin. On no account dust the hen just before the hatching-period, or when the chicks are very young, as the powder is apt to get into the chicks' eyes and cause blindness.

It is a mistake to interfere with the hen when the chicks are hatching; remember that she is past the experimental stage and can manage best by herself. It is always a mistake to give a hen with a young brood a free range, as there is always the risk of the chicks being taken by cats. Besides, the grass may be long and wet, and this is apt to have an injurious effect on the little birds.

A hen should never be set on valuable eggs at the first sign of broodiness. The best plan is to try her first on some dummy eggs. Many valuable sittings of eggs have been scratched about and broken through their being placed under hens which did not at the time possess the right sitting desire. After five or six days the eggs should be examined by means of a tester, and any which are infertile or contain dead germs should be removed.

LITTER.

A correspondent desires to know the cause of the litter in his fowl-house piling up under the dropping-boards and perches. This is due to the fact that the birds when scratching for their food in the litter always work with their heads towards the light. Thus as the litter is daily scratched back it necessarily follows that it soon becomes piled up at the back of the house. No doubt if light were provided by means of glass frames being placed low down in the back wall of the house the trouble would be minimized. It is questionable, however, whether the expense of doing this is warranted, as, after all, it is not a big job to frequently spread the litter with a fork, and from all standpoints will have a beneficial effect.

GREEN FEED.

I would again emphasize the importance of losing no time in making every possible provision for the growing of ample green material. No flock can possibly thrive without it, and this applies specially to growing chickens. An abundance of green feed not only greatly assists in keeping the birds in a healthy state, but in addition it reduces the grain account. It is common for both growing and adult stock to go off their grain ration when hot-weather conditions prevail, but rarely if ever will they refuse succulent green material. Where possible a variety of green feed should be provided, as birds of all ages are apt to tire of any one particular kind when it is fed in surfeit. For example, I have seen flocks of poultry absolutely refuse to eat silver-beet, as they had received nothing else as green feed for months previously. Finely chaffed succulent grass, lucerne, clover, and green oats are ideal green foods for poultry, while any of the brassicas (cabbage family), lettuce, or silver-beet will be much relished.

CULLING THE POOR LAYERS.

This is not the time of the year for culling poor layers; it should have been done in the autumn. It may be true of many flocks of hens that they have eaten much costly food of late, but produced few, if any, eggs. The natural laying season is now at hand, and it will be a very inferior bird that will not give a profit over its keep until just before the next moulting season commences. If eggs in good numbers are to be secured during the dear season, sufficient pullets must be reared each year to replace a good portion of the adult stock. Not only this, but they must be brought out at the right season of the year, which is between now and the end of September, or early in October at the latest.

REARING DAY-OLD CHICKS.

Many people who purchase day-old chicks and adopt the natural method of rearing them make the mistake of giving the hen charge of the young birds only a day or two after her broody period has commenced. This invariably means that the hen does not take kindly to them, and as a result the chicks get chilled. Another drawback is that the hen will probably resume laying in a short time, and cease to properly mother the chicks until they are able to look after themselves.

When a broody hen is being used for mothering artificially produced chicks it will be wise to allow her to sit on the nest for at least ten days

before giving her the care of the young birds. As a general rule, the longer the hen is allowed to remain broody—up till, say, three weeks—the better will she mother the incubator-hatched chicks. Where trouble is experienced in getting a hen to take charge of chicks not hatched by herself it is a good plan to take each chick and work it well between the hen's underfeathers. Especially is this the case with chicks hatched by another hen. The operation should be carried out when it is dark.

EMDEN GEESSE.

A correspondent is desirous of securing some purebred Emden geese or eggs of this breed. I should be glad to have the name and address of any breeder who has either birds or eggs available for disposal.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

BREEDING.

COLONIES in normal condition should now have a good quantity of sealed brood in the combs, and young bees emerging every day. The queens will be laying well, though not up to their full capacity; but their powers in this direction will increase with the approach of warmer days. The first bees bred this season will soon be acting as field-bees, and the older autumn-bred ones will be dying off rapidly. Breeding should be kept going steadily without a break, as it is necessary that each colony should grow in strength in order to be in a condition to take advantage of the first flow from the early nectar-secreting plants.

Food and warmth are the main factors in promoting steady breeding, and these should have constant attention. It is well to remember that when breeding is in full swing a considerable amount of food is used up every day for feeding the brood. All through the spring, when weather conditions are favourable, some nectar can be gathered, and often a good deal is stored, which helps to supplement the stores in the hive. However, there are times when, through bad weather, the bees are unable to do this. Where such conditions last several days the food-supply will diminish rapidly, and the bees may be reduced to starvation before the beekeeper is aware of their condition. August and September are critical months in this respect, and if a spell of bad weather is experienced it is well to ascertain the condition of the food-supply in each hive, and feed without delay where necessary.

HINTS TO BEGINNERS.

There are a few points which every beekeeper should bear in mind when starting an apiary. The stocks must be clean and in good condition. No beekeeper can hope to succeed with poor bees, and no one but a novice would tolerate other than strong colonies. The hives should be well made and painted; cracks and knot-holes may be of use for ventilation in the summer, but at any other time of the year they absorb much of the bees' time in gathering propolis to stop the draughts; moreover, any holes besides the entrance offer an inducement for robbers to investigate, and necessitate the bees employing

extra guards to prevent attack. A careful watch should be kept on the stores, so that the bees may not starve. It is far better to overfeed than underfeed, for, as already indicated, it is amazing how quickly a colony will deplete its stores when brood-rearing commences in the spring. More feeding means more brood; but, once commenced, it must be continued until the hives show actual proof that they are gathering sufficient nectar to keep themselves going. Feed only in the evening, inside the hives, and use a syrup in the proportion of two parts water to one part sugar; dissolve thoroughly, and feed as soon as it has cooled sufficiently to be harmless to the bees.

Provide permanent shelter; a live hedge is the best if kept trimmed to a height of 8 ft. or 10 ft.; failing this, some kind of breakwind is essential. The hives should never be exposed to high winds, as, in addition to the danger of the roofs being blown off, cold draughts check brood-rearing to a very great extent.

Open the hives only on warm, still days. Make necessary observations as quickly as possible, and take a note of them at once. The inside of the cover makes a good rough diary, and does not get lost or mislaid; mark the date of each examination. Endeavour to distinguish the sex of the brood at a glance, and keep a sharp lookout for the queen; she is easily distinguished by the length of her body and the comparative shortness of her wings. Try to make a rough estimate of the weight of each frame as you lift it, comparing it in your mind with that of an empty comb, thereby arriving at some idea of the quantity of stores in each hive. Do not try to run many hives until the rudiments of the business have been grasped, but be content with one or two strong colonies until the learner's stage has been passed.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

TOMATOES AND OTHER FRUITS.

TOMATO-PLANTS in the cool greenhouse will now be getting established. If the soil was well saturated before planting, further supplies of water should be given with caution at this season; anything like a moist atmosphere is to be avoided. Then, with a minimum temperature of 55° F. at night, and a little ventilation as soon as 65°-70° is reached during the day, the plants should make steady growth and fruitful flower-trusses. Close the houses early in the afternoon before the temperature declines. While the plants must not be grown soft, remember it is a sudden chill which causes the check that is so often manifested by blossoms falling without setting. Watch the plants closely until feeling sure they are established satisfactorily. A little fertilizer will push them if they are slow, or steady them if inclined to bolt—a tendency that is rather the more dangerous and common of the two.

Seeds for outside crops may be sown now. The common practice of making one sowing and holding the plants over for later planting is not good. The check given to the plants in that way is recovered, but not in a manner satisfactory to the commercial grower who

requires good bottom bunches at an early date. Peppers and egg-plants may be included in this sowing; they require similar treatment. Very little extra heat will be required in the frames if the place is well sheltered. Have extra covers ready for a frosty night.

Consideration should be given to the area in which these plants are to crop. If the ground is under green cover-crop at the present time the growth should be ploughed in. If the plants are to follow winter broccoli or cauliflower the land should be cleaned up as soon as it is available, ploughed, and in most instances given a fair dressing of burnt lime. The preparation should also include a light stroke of the harrows or cultivator during bright, dry weather, and at short intervals, to destroy weeds.

Where passion-vines have to be planted they should be put out now, also any hardwood fruit-trees and bushes that may be decided on. This class includes one or two interesting novelties that are now available in small numbers and ready for trial. The Chinese gooseberry and the blueberry are both genuine novelties here, and popular useful fruits where they are grown. The former is a handsome deciduous climber that is doing well in alluvial soils. It is standing our frosts well. The fruit ripens in autumn, and may be kept for some time; it may be used for dessert or preserves. The stamens and fruit are borne on separate plants—the plant being dioecious. The blueberry is a very hardy plant which prefers drained acid soils. Some of the varieties introduced bear fruit of good size, and promise to do so abundantly.

Fruiting brakes will now require careful consideration and inspection for any sign of disease. Bordeaux mixture and arsenate-of-lead sprays should be used freely where the health record has not been up to the mark. The lead is a check on grubs and eating-insects, such as those that attack the canes and buds of raspberries in the spring. The ingredients may be mixed into the one spray, and it is then a very excellent remedy.

TOBACCO-GROWING.

The new crop: Where the tobacco seed-beds are inclined to be wet they will require airing occasionally; although they must not be allowed to become dry, too much moisture is equally undesirable. Keep a sharp lookout for the attack of vermin, and deal with it promptly. A successful crop depends on, as much as anything, good early plants; these may now be produced by close attention to detail. Sow another seed-bed now; never mind if it is more than you require. There are many risks to encounter, and the safe way is to have plenty of plants, both early and later. Where the seeds come up thickly, thin them out to about 1 in. apart; crowded, they can never make good plants. Continue the preparation of the land where the crop is to be grown to maturity. If it is at all exposed to winds, plan to plant a shelter-crop at intervals so as to afford protection. The land should be ready for planting towards the end of October, when it should present a clean, firm, smooth, fine bed for the plants.

Home fermentation: Growers experimenting with tobacco, and who have a small quantity of last season's leaf which they wish to

ferment and prepare for smoking, may bulk it now. With a small quantity this is best done in a box of convenient size. When the leaves are in a pliable condition, remove the midrib and spread the leaves in the box with the tips towards the centre. Moisten each layer with a fine spray till it is carrying about 15 to 20 per cent. of moisture. When the box is full, place boards over the top and a moderate weight, so that they may compress the tobacco. Cover with a waterproof sheet, and keep the box in a temperature of about 70° F. Inspection should be made from time to time to ensure that the temperature of the leaf does not rise too quickly; 10 to 12 degrees per day is sufficient, and it should not much exceed 100° F. Should it do so, it will be advisable to break down the leaf, air it, and rebuild the bulk. After a few weeks the heat will subside and the tobacco be ready for use. It will, however, improve with age under proper storage up to about four or five years.

MARKET-GARDEN SUPPLIES.

The spring crops of cabbage, cauliflower, and lettuce will now be maturing for the harvest. Cabbages may sometimes be induced to produce a second crop by giving the roots a dressing of nitrate of soda and thinning the young sprouts.

Rhubarb and asparagus beds will also be presenting a profitable crop where they have been well fed and allowed to make strong autumn growth. The feeding of these strong-growing crops requires careful consideration. An application of nitrate of soda, 1 oz. to the square yard, on the asparagus-beds will be beneficial at the present time.

Every advantage should be taken of the occurrence of fine weather to thin and weed the growing crops. A small application of nitrates may be given to such as appear backward or slow in making satisfactory growth.

The preparation of the land for the main and half-hardy crops and seed-beds for autumn crops should now be in hand. Arrange that they follow crops of a totally different character, and so avoid disease and use the plant-foods in the soil with economy.

LAWNS AND SUNDRY PLANTING.

Mowers will require to be keen and well set to deal satisfactorily with the heavy work of the next two months. Every care given to these delicate machines will be well repaid by easier and better work. Lawns that have been well top-dressed with other fertilizers may now be given a dressing of sulphate of ammonia to encourage the growth of the finer grasses.

The planting season for hard-wooded plants closes with the month of September, and the sooner such work is completed the better. The chief danger of late planting is the possibility of a dry spell delaying the establishment of the plants before the warm weather arrives.

—W. C. Hyde, *Horticulturist*, Wellington.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

SELECTION OF RAM FOR BREEDING.

A. MORTENSEN, Ngataniro :—

I would be obliged if you could give me a few hints about how to pick a good Romney ram for wool, shape, and quality.

The Live-stock Division :—

This subject was dealt with in an article entitled "The Ram and his Characteristics," published in the *Journal* for October, 1922, a copy of which has been sent to you. A few further hints may be added. In all the hornless breeds of sheep the space between the ears should be as level as possible. Moreover, a good width here means a good width between the eyes, and this is a very desirable characteristic. The ears should be fairly well set up and not lopping down. The pure-wool fibres in a fleece are of a soft silvery appearance, and are elastic throughout. This is the wool required by manufacturers. The hairy-wool fibres, on the other hand, are a white colour and non-elastic. One must look for these fibres mostly in the britch, and by selective breeding avoid them as far as it is possible to do so. When doubtful which ram to finally select out of any submitted for examination, other points being equal, take the one with the broadest pad in the top jaw and with the almost square-shaped hoof.

GROWING OF ARTICHOKEs.

J. R. SMART, Tikorangi :—

Kindly give me instructions how to plant artichokes and to cultivate same. Also, is there a spray for the blight that attacks them ?

The Fields Division :—

Artichokes are grown much on the same lines as potatoes. Planting may be done in your district any time after 1st September. Plant in drills 3 ft. apart, and set the tubers 2 ft. apart in the rows. From 5 cwt. to 7 cwt. of seed per acre is required. If the seed is small, plant whole, but if big, break into sets. In buying seed, arrange to have it dug just before required. There are two varieties grown in Taranaki, the pink and the white. The latter is rather the heavier cropper, but is more liable to attacks of blight. Care should be taken to get seed free from blight. Spraying or dipping affected seed or crops does not appear to be very effective (see article, "Fungus Disease attacking Artichokes," in the *Journal* for June last). A suitable manure for artichokes is 3 parts super, 1 part bone or Nauru phosphate, and 1 part 30-per-cent. potash—4 cwt. to 6 cwt. per acre ; or a proprietary mangold or potato manure may be used.

PASPALUM FOR SWAMP LAND AND COASTAL FLATS.

"KAI KAI," Marton :—

Can you tell me if it is safe to sow paspalum on rich swamp land ? I am afraid of it becoming a nuisance, like giant fescue, on this class of country. I would like also to know whether in your opinion paspalum is suitable for light sandy soil and the small poor flats that are to be found near the coast between sandhills in this district.

The Fields Division :—

If the swamp land is not likely to be drained and broken up for a considerable period it is quite safe and good practice to sow it in paspalum. This grass will not become a nuisance like giant fescue, as stock are very fond of it, and do well on it. In our opinion paspalum is the best grass available to sow on the light flats you mention. If it is used for this type of land from $\frac{1}{2}$ lb. to 1 lb. of subterranean clover should be sown with it, as the two grow well in association. Examples of paspalum on the type of flats you mention are to be seen on portions of the Hellier Estate, below Bull's.

CHAFF FOR PIG-FEEDING.

"PIGGIE," Te Kopuru :—

Kindly advise if it would be injurious to feed pigs on chaff with an addition of meal. I notice young pigs relish chaff, and as I have a considerable amount on hand it might be better to give it to the pigs than dispose of it by sale. The pigs are on top-dressed pasture, supplemented with meal and turnips.

The Live-stock Division :—

Chaff is not a suitable food for pigs, and it is doubtful whether the animals are really fond of it. No doubt they are trying to pick out the oats from among the chaff, and in doing so are compelled to eat a certain amount of the latter, which is hard to digest and of little feeding-value for pigs. If you have no other means of feeding your chaff it had better be sold, when the value received could be spent on pig-meals, which would show a better return.

SMOKING OF HAMS AND BACON.

F. ROCKELL, Kaikohe :—

As we intend to smoke our bacon this year I would be glad of your advice on the subject. Could the smoking be done in an ordinary farm-shed? To what temperature is it advisable to let the smoke-house come? Does it matter what fuel is used? How long should the bacon stay in the smoke-house?

The Live-stock Division :—

Any tight house with ventilation in the top can be used to smoke meat in. First of all, however, the sides and hams to be smoked should be well washed and hung up outside to dry. As regards temperature in the smoke-house, it is not usual on a farm to pay any attention to this. If the house has a ventilator at the top, and the fire is not allowed to burst into flame, but only smoulders, the temperature will not go up too high. Resinous-pine woods should be avoided, as they give a bad flavour. Straw, sawdust, and dry leaves are commonly used, but probably the best is rimu sawdust spread over logs and shavings. The period for the bacon to remain in the smoke-house may extend from forty-eight hours to two weeks if desired.

TEMPORARY PASTURE AND SMOTHERING OF COUCH.

A. L. ROSS, Matiere :—

I am ploughing a 7-acre paddock which was in rape, with the intention of sowing Western Wolthys rye-grass and cow-grass for a hay crop. The paddock is fairly couchy, and I would like advice on the most suitable mixture for hay to last about two years, and that would also help to smother the couch-grass.

The Fields Division :—

The paddock should be sown in the spring with a smothering-crop of oats or Black Skinless barley. This could be fed off during late summer, and a temporary pasture mixture of 25 lb. Western Wolthys rye-grass and 6 lb. cow-grass per acre sown in the autumn. As an alternative to this you could sow the grass with the oats in spring, and thereby save a further ploughing; but, since the function of the cereal crop is to smother the couch during its most vigorous growing period, this method would not always be satisfactory to the early development of the temporary pasture.

RYE-CORN FOR POULTRY.

B. C., Middlesmarch :—

Please tell me if rye-corn has any value as poultry-food.

The Live-stock Division :—

Rye-corn is not a popular grain for poultry-feeding. Fowls do not like it, and will seldom eat it if other food is available.

NOTE.—C. McGregor, "Central Otago" (inquiry regarding shelter-belt), should forward his postal address.

WEATHER RECORDS : JULY, 1927.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE total precipitation of the month was above normal over the North Island, with the exception of small areas about Cook Strait and at Kawhia and Gisborne. In the South Island there were considerable local variations in the amounts measured, but Nelson and Marlborough had an excess, and also isolated places on the east coast and in western Otago. Westland, North Canterbury, and most parts of Otago recorded less than the mean. In some districts, notably in the Bay of Plenty and Hawke's Bay, the excess was considerable.

There were three outstanding storms during the month, which may be briefly described as follows: A cyclone from the north-westward was centred over the Auckland Peninsula on the 1st, and passed off East Cape on the night of the 2nd. On these two days some phenomenal rainfalls occurred in the Gisborne and Hawke's Bay districts, resulting in serious floods in the low-lying country. Between the 9th and 14th an intense and extensive westerly low-pressure area dominated, with strong northerly winds changing to southerlies about the 13th. Much rain fell during this period, and on the 13th there were heavy snowfalls on the high country in the South Island, also in the central portion of the North Island. Waiouru recorded a fall of 17 in., and at Taumarunui it was regarded as the heaviest fall since 1918. From the 25th to the close of the month a wide and extensive cyclonic disturbance operated between New Zealand and Australia, and conditions were again extremely unsettled, with strong north-east to south-east winds. Although precipitation came mostly in the form of drizzle, some heavy rains were occasionally experienced, particularly in the northern and east coast districts on the 25th and 26th.

In many parts of the North Island the continuous rain accounted for serious floods and landslips, which interfered with railway and other traffic.

Fair weather ruled between the 3rd and 8th, and other shorter fair periods were experienced, but usually the duration of sunshine was below the average. Temperatures, however, were about normal, and above the mean of the preceding month. Generally there was a good growth in vegetation for the time of year.

RAINFALL FOR JULY, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
<i>North Island</i>				
	Inches.		Inches.	Inches.
Kaitiaki	11.01	21	2.72	5.96
Russell	8.24	15	2.16	4.94
Whangarei	9.73	21	2.19	7.53
Auckland	8.47	29	2.88	4.98
Hamilton	6.85	24	1.40	5.02
Kawhia	6.41	26	1.07	6.86
New Plymouth	7.48	25	1.33	6.28
Riversdale, Inglewood	9.97	25	1.58	9.93
Eltham	7.53	27	0.87	5.55
Whangamomona	8.24	20	1.33	7.68
Tairua	1.44	20	2.53	5.15
Tauranga	11.10	23	2.58	4.86
Marachako Station, Opotiki	10.26	17	2.64	4.09
Gisborne	4.98	10	2.23	5.14
Taupo	4.89	9	1.67	4.21
Napier	5.14	15	2.13	3.90
Maraekakaho Station, Hastings	8.00	16	3.02	3.65
Taihape	3.19	18	0.79	3.15
Masterton	4.67	21	0.86	4.31
Patea	4.30	17	0.93	4.10
Wanganui	1.45	5	0.93	3.52
Foxton	2.34	13	0.80	3.09
Wellington	3.46	20	0.50	5.55

RAINFALL FOR JULY, 1927—continued.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average July Rainfall.
<i>South Island.</i>				
	Inches.		Inches.	Inches.
Westport	6.20	20	1.34	6.99
Greymouth	7.36	16	1.40	7.84
Hokitika	8.54	17	2.45	9.08
Ross	6.63	13	1.84	9.94
Arthur's Pass	10.88	13	4.03	11.55
Okuru, Westland .. .. .	..	..	..	12.03
Collingwood	16.75	17	3.32	9.65
Nelson	6.39	12	1.90	3.49
Spring Creek, Blenheim	3.92	10	0.83	3.40
Tophouse	5.10	11	1.25	4.79
Hammer Springs	4.20	14	1.46	4.65
Highfield, Waiau	3.24	13	1.90	3.44
Gore Bay	3.60	17	1.11	2.84
Christchurch	2.46	15	0.78	2.76
Timaru	2.72	11	0.68	1.93
Lambrook Station, Fairlie	2.14	8	0.74	2.61
Benmore Station, Clearburn	1.84	12	0.54	1.74
Oamaru	3.99	11	0.91	1.74
Queenstown	2.41	8	0.50	2.04
Clyde	0.76	5	0.47	0.94
Dunedin	7.51	15	2.57	3.01
Wendon	1.36	9	0.30	1.98
Gore	1.75	17	0.45	1.96
Invercargill	2.86	21	0.50	3.28
Puysegur Point	9.44	15	1.02	6.18

GRADINGS OF BUTTER AND CHEESE, SEASON 1926-27.

THE Dominion quantities of butter and cheese graded for export by the Dairy Division during the twelvemonth ended 31st July, 1927, were as follows:—

Butter: Salted, 69,433 tons; unsalted, 2,262 tons total, 71,695 tons—an increase of 14.6 per cent. compared with the figures for the preceding twelvemonth.

Cheese: White, 50,427 tons; coloured, 25,885 tons: total, 76,312 tons—an increase of 2.9 per cent.

In terms of butterfat, the 1926-27 amounts for butter and cheese combined represent a net increase of 10.47 per cent. compared with those for the preceding year, and an increase of 4.77 per cent. over those for 1924-25, hitherto the peak production year. A new high-level record has thus been established.

Grading-weights of Lambs.—"The suggestion was made some time ago," states the annual report of the Meat Board, "for an alteration in the grading-weights of lambs, by extending the range of weights so as to allow heavier lambs to be included. The Board does not consider that alterations along these lines would be in the interest of our trade, for they would be against the requirements of the Home trade, and it is essential, if we are to hold our own with the keen competition of other countries, that we give consideration to and comply with the requirements of our customers."

DAIRY FACTORIES IN NEW ZEALAND, 1927.

THE following table presents the registrations of factories under the Dairy Industry Act as at 30th April last, together with the quantities of butter and cheese forwarded to grading-stores for export during the year ended 31st March, 1927, and the numbers of milk or cream suppliers to the factories:—

District.	Number of Factories.				Forwarded for Export, 1926-27.		Number of Suppliers to Factories.	
	Butter.	Cheese.	Dual Plant.	Total.	Butter.	Cheese.	Butter.	Cheese and Dual Plant.
					Tons.	Tons.		
Auckland ..	65	36	6	107	43,081	11,612	17,100	1,327
Taranaki ..	24	74	35	133	7,901	33,039	3,271	3,466
Wellington ..	19	49	10	78	7,002	11,277	4,958	1,627
Hawke's Bay ..	14	15	3	32	2,364	3,004	3,594	519
Nelson ..	6	5	2	13	1,045	438	1,075	455
Marlborough ..	3	1	4	8	699	669	750	185
Westland ..	9	..	1	10	371	..	639	30
Canterbury ..	9	12	5	26	2,138	1,966	4,425	2,296
Otago and Southland	13	77	2	92	2,250	13,360	6,660	2,730
Totals ..	162	269	68	499	66,851	75,365	42,472	12,635

When butter was manufactured as a side-line at eighty-one of the above cheese-factories in 1926-27, the total quantity forwarded for export being 1,036 tons. This is not included in the total amount of 66,851 tons of butter given in the table, which refers to creamery butter only.

In the 1926-27 period there were also operating in the Dominion six milk-powder factories (three whole-milk and three skim-milk plants), four casein-factories, one condensed-milk factory, and one sugar-of-milk factory.

VARIETIES OF APPLES AND PEARS EXPORTED, SEASON 1927.

THE following particulars of the varieties of apples and pears exported from New Zealand in the past season have been compiled by the Horticulture Division from export certificates. The figures for apples represent 1-bushel cases, and those for pears crates consisting of three trays, each tray containing from 10 lb. to 12 lb. of fruit.

Apples.—Sturmer, 157,358; Jonathan, 118,556; Delicious, 91,063; Dunn's, 28,368; Cox's Orange, 24,347; Dougherty, 18,961; Statesman, 16,519; London Pippin, 9,082; Cleopatra, 7,626; Worcester Pearmain, 5,979; Lord Wolseley, 4,616; Premier, 3,607; Rome Beauty, 5,815; Rokewood, 2,608; Newtown Pippin, 2,510; Scarlet Nonpareil, 2,539; Tasma, 2,410; King David, 2,171; Ballarat Seedling, 2,076; Stayman Winesap, 2,169; Alfriston, 1,909; Adams Pearmain, 1,566; Pioneer, 1,317; Gravenstein, 1,244; Spitzenberg, 1,164; Stark, 789; Granny Smith, 718; Willie Sharp, 511; Brownlee's Russet, 507; Hoover, 430; Ribston Pippin, 410; Washington, 445; Salome, 379; McIntosh Red, 397; Shorland Queen, 377; Simmonds Winter, 311; Yates, 262; Boston Russet, 164; Baumann's Reinette, 150; Blenheim Orange, 100; Edward Lippiatt, 100; Rona, 97; Parlin's Beauty, 95; Golden Pippin, 84; Frimley Beauty, 64; Shepherd's Perfection, 54; Cambridge Pippin, 50; Celo, 37; McMahon's White, 25; Senator, 10. Total number of cases, 522,146.

Pears.—P. Barry, 6,835; Winter Nelis, 4,368; Winter Cole, 4,063; Keiffer, 1,676; Vicar of Winkfield, 1,444; Josephine de Malines, 1,230; Beurré Clairgeau, 861; Packham's Triumph, 432; Beurré Bosc, 313; Elizabeth Cole, 273; Beurré Diel, 160; Doyenne du Comice, 128; Beurré d'Amanli, 90; Conference, 67; Glou Morceau, 60; Beurré d'Anjou, 28; Le Conte, 25; l'Inconnue, 19. Total number of crates, 22,072.

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BRAXY-LIKE DISEASE OF SHEEP IN HAWKE'S BAY.

ITS ASSOCIATION WITH LIVER-FLUKE.

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FOR many years farmers in a portion of Hawke's Bay Province have been losing sheep from a trouble resembling braxy, yet differing in many respects from that well-known disease. So serious were losses on certain farms that active investigation by the Department of Agriculture became a necessity. Farmers in the district in question could readily understand losses from such causes as liver-fluke, but at certain times of the year the braxy-like disease was taking toll daily of the best-conditioned animals in the flock, and death came so suddenly that a sheep might be found lying where the observer had walked scarcely half an hour previously, when all appeared to be in normal health. Usually, however, deaths occurred on the night camping-grounds, and it was common to find perhaps half a dozen sheep lying on their sides—apparently asleep—in those places. On cold, frosty mornings such carcasses would be in a fairly well preserved condition in spite of the amount of wool covering them, while rigor mortis had frequently not set in.

In earlier years, when large stations were usual, the condition described was apparently unknown, but at that time the liver-fluke took its toll, and a number of owners drained their land for the purpose of destroying the parasite. In later years, when large properties were cut up into 1,500- to 2,000-acre blocks, more sheep were run on the land, and it was then that the disease in question made its appearance.

The disease was called "braxy-like" on account of the sudden death of the animal, the typical smell, and the skin-discoloration. It did not resemble braxy in that sheep of any age might be affected, and no stomach or intestinal lesions could be found as in true braxy. It is of interest to note here that true braxy, caused by a bacillus named *Vibrion septique*, is unknown in New Zealand. Also, deaths from true braxy occur only in frosty weather, while in the trouble now under notice weather conditions do not control the course of the disease to the same extent.

On farms where one comes across the mortality the country is usually hilly but rideable on horseback, lying fairly near the sea-coast, well watered, and holding many small swamps, a feature which old settlers view with satisfaction, as such places ensure green feed in dry weather. The soil makes a very tenacious form of swamp when it is washed into the creek-bottoms during heavy storms, and the great number of springs to be seen on the hillsides, each with its little bog, makes drainage a really difficult problem. Because of these swamps and the presence in them of the intermediate host snail, together with the warm climate, liver-fluke is prevalent in this area, but, curiously enough, stomach-worms in the hoggets are not of very great account. The water of the district is alkaline in reaction (pH 7.2), and many outcrops of limestone are seen on the ridges. Feed grows most of the year, and when rain is sufficient the sheep need only go to the creeks for water. A proportion of sheep, however, always appear to prefer the rank feed of the swamps. Another fact which strikes the observer is that on nearly every farm many bones are found lying about. This is accounted for by deaths caused chiefly by drought, but also by fluke and the braxy-like disease. Shepherds have taken the wool off the carcase and left the latter to rot, with the inevitable result that the soil is dangerously fouled, especially in and about watercourses or swamps. The wonder is that there is not a greater mortality from the numerous gas gangrene organisms which must be present. On most properties in the district this treatment of carcases has gone on for some forty or fifty years. Common-sense warns one to bury or thoroughly burn. In the South Island at one time there were many outbreaks of a somewhat similar disease where hoggets on turnips died suddenly. This was overcome mainly by correct disposal of carcases.

As weather conditions are one of the factors in the normal mortality of sheep of the district some attention should be paid to this phase. In 1924 a very heavy flood washed out all the watercourses and freed the many gullies of their swamps. The following season fluke is said to have been less harmful, owing to the fewer snails. The summers of 1925 and 1926 were very dry, particularly that of 1925, when a real drought was experienced. Deaths from all causes were very heavy in that year; but there was very much less water about the country in the winter of 1926, so that there appeared to be a lessened fluke infestation in the summer and autumn of 1926-27. The warm weather, however, appeared to commence exceptionally early after the winter of 1926, and the larval fluke made its way through the snail host at a very much earlier period than usual. In fact, flukes were passing into the sheep last New Year. Quite a decided wave of the braxy-like disease appeared at this time, and was prevalent more or less for a couple of months, when it quietened down, to reappear about the beginning of May. The usual months to expect to find sheep dying suddenly are from May to August, but much depends on the weather. If many frosts occur the disease may end earlier, or if sheep are able to stay out on the hills feeding, instead of having to seek the damp bottoms during the summer, then mortality from all causes is light.

POST-MORTEM EXAMINATION.

The most active work of the investigation commenced last year, when a stay was made on several farms with the object of getting

material for laboratory examination and experimentation. Many sheep were examined after death for some lesion which might give a clue to the cause of death, and the conditions described below were always encountered in every carcase, whether ram, ewe, wether, or hogget. Age had no influence on the course of the disease.

Sheep were lying either naturally or on their sides, with rarely any sign of a struggle; pupils dilated; wool easily plucked. If an hour or two dead, the skin was very dark, due to congested blood-capillaries. There was a definite smell, not of a putrefactive nature, but unpleasant, said to be somewhat like that of braxy. On opening the carcase the thorax showed the lungs usually normal, but occasionally oedematous at the apex. Often a straw-coloured or slightly blood-stained fluid was present in the chest-cavity, while the pericardial sac surrounding the heart was tensely distended with straw-coloured fluid. The heart itself showed small petechial areas mainly over the auricles, and the endocardium showed a marked staining, a condition often seen in toxæmias. In the abdominal cavity congestion of capillaries of the omentum was noticeable. Sometimes a fair quantity, up to a cupful, of straw-coloured or slightly blood-tinged fluid was to be seen, but usually in recently dead sheep only a tablespoonful or so of such fluid could be found, though the peritoneal lining appeared damper than in health. Thorough examination of the gastro-intestinal tract showed absolutely no trace of braxy lesions, but there were some patchy flushings of the stomach mucous membrane and some inflammation of the duodenum about the entrance from the stomach, particularly in every case at the flexure of the duodenum beneath the liver in the vicinity of the entrance of the bile-duct from the liver. The large intestine was often inflamed and catarrhal, but this appeared to be more seasonal than pathogenic. There was some congestion of the kidneys, but a pulpy condition as seen in toxæmias, considered to be due to protein in breakdown products of food (for example, in pulpy kidney of lambs), was not observed. The spleen and other organs were normal, except the liver.

The liver appeared to be the chief seat of change. The district, it must be remembered, is a fluke-infested one, and adult flukes were frequently met with in the bile-ducts of the liver; but in all livers one impressive fact was the presence of young flukes which had just entered the capsule and had not reached the small bile-duct. Some flukes were actually seen penetrating the capsule of the liver, the size of such specimens being about $\frac{1}{8}$ in. In the 1927 investigational work often only one young fluke was found in the whole liver, while in 1926 sometimes dozens could be counted. Young flukes burrow here and there in the liver substance, seeking a bile-duct in which to mature, and during their burrowing cause a very great damage to liver-tissue. These burrows are filled with blood-corpuscles, both white and red, and are in reality areas of acute inflammation under normal conditions, owing to the body's physical objection to the entry of a foreign material into its substance. Besides the young flukes, in 100 per cent. of authentic cases there was to be found in the liver a small necrotic area or grey-white patch, commonly the size of a threepenny-piece, and surrounded by an intensely hyperæmic area of liver for possibly 2 in. (Fig. 2). Such necrotic areas followed one of the fluke-burrows. It was not necessarily always on the surface of the liver

that the necrosis could be seen, but in some cases, by careful observation, congested areas could be found on the surface, with a central necrotic area deep in the liver-substance. Young flukes were several times observed dead in such areas.

In contradistinction to the foregoing cases, in both seasons several sheep were seen to die having as chief lesions an acute congestion of the central veins of the lobules of the liver, but they showed no area of necrosis, although young flukes were present. In such cases, too, death was not so sudden, but might be a question of many hours, the sheep comatose, often with its head pushed into a fence or other object which it had come against in its semi-conscious and blind wanderings. In one such case there was a great deal of cirrhosis of the liver due to fluke invasion some time previously, while in another the sheep had been drenched with carbon tetrachloride, the liver being fatty and to some extent cirrhotic.

MICROSCOPICAL EXAMINATION.

The findings of a microscopical examination of fluids and tissues depended largely on the time which had elapsed after death. Sheep recently dead did not show organisms in the peritoneal fluid nor in the substance of the liver, except in the necrotic area. The muscular and peritoneal coat of the intestines taken from over the flexure near the liver in the few cases examined showed a large bacillus, but these organisms may have got there after death. Pericardial fluid and blood were both sterile. Where an organism was definitely present was in the central necrotic area of the liver, and here in every case a large bacillus was found, occasionally showing spores, a fact which suggested that it was not an accidental organism introduced after death. Those lesions in the heart-walls showed a congestion of blood-spaces beneath the endocardium, in some cases so large as to be hæmorrhages. The intestinal and stomach walls showed no abnormalities which could be associated with the disease, except a congestion of the capillaries in parts of the mucous membrane. Organisms could be seen in some cases entering via the peritoneum, but in no case was one fortunate enough to observe the path of entrance of young fluke with the possible path of invasion of the organism causative of death.

Sections of the necrotic areas of the liver under the microscope were exceptionally instructive, and could be described as a battle on an intense scale between the enterprising invading enemy—the bacillus, which used a particularly deadly toxin to do its work, causing the coagulative necrosis of the liver-tissue—and the blood forces of the body. The congested area contained armies of blood-corpuscles massed ready, the white corpuscles to phagocyte or produce antitoxin against the bacillus, and the red to carry oxygen to the part for the use of the body-tissues. Felted masses of the invading bacilli could always be seen under the microscope against a thick wall of leucocytes (white corpuscles). Behind the massed bacilli were odd single members throughout the necrotic area. In some cases the burrowing fluke had been overtaken, and had been poisoned and treated in the same way as the liver-tissue itself. Sporulating forms of the bacillus were noticed in several cases, leaving no doubt that the organism had been in position for at least eight hours, while the sheep had possibly been dead less than one hour.



FIG. 1.—SHEEP DEAD FROM BRAXY-LIKE DISEASE.

This animal was found lying with head downhill, as though it had stumbled and died without struggling.



FIG. 2.—SHEEP'S LIVER EXAMINED IN FIELD.

Showing a darkened congested area with central necrotic spot (indicated by arrow). The distended gall-bladder may be seen at bottom of liver.

FIELD-LABORATORY WORK.

Culture material was utilized in 1926, but, unfortunately, no results of any significance were obtained. This year, however, a small field laboratory, with incubator, guinea-pigs, and a microscope, was taken to one of the farms, and preparations made for an intensive investigation, it being decided that no opportunity for securing good specimens should be lost. In May fortune attended the venture, and an organism was isolated from a sheep's liver, both by inoculation of a guinea-pig and by growing the material anaerobically in broth with a portion of the liver added. A flocculent growth of a large bacillus growing singly or in large chains, and in size about 1 by 8 micro-millimetres, with ends slightly rounded, gram-positive, and strictly anaerobic, resulted in the tube. It was found to grow well in a medium made of cooked minced liver, either sealed or unsealed, also in liver-broth if a small portion of meat was added. Growth occurred in cooked-meat media made of bullock's heart, but not so much on the surface as in the bulk of the medium, where it formed large oval almost terminal or eccentric spores. Other media were of little use; milk showed no growth after ten days, while no growth could be obtained in visible colonies on anaerobic surface media in glucose or lactose agar. In solid media, however, it seemed that if thin slices of the surface were taken and stained, colonies of some hundred or so organisms could be seen, the colonies being very feathery. No colonies which could be definitely identified as the original organism could be obtained in shake glucose or lactose agar, while no growth at all occurred in gelatine. Therefore, as a routine, cooked-liver medium was used. The drawback was the very acid reaction produced in the medium after a few hours' incubation, this tending to kill out the organism altogether after a period of two months (so it was subsequently found), the more so as spores were not readily formed in such medium. No blackening of media occurred, the organism being purely a sugar-user.

Guinea-pig subcutaneous inoculation has given typical lesions in every case. With 0.2 c.c. of culture, or with a small portion of liver from the sheep, the guinea-pig dies within twenty-four hours. Within six hours the leg is swollen, and shortly afterwards the animal is moribund. Peritoneal inoculation, on the other hand, has not caused death so readily, and in some cases the experimental animal has shown no ill results. In carrying out experimental work at Wallaceville with the isolated organism it was found that inoculation of sheep with a small amount of culture into the liver directly caused death of the animal in twenty-three hours, with all lesions typically presented as though the sheep had died on a farm in the affected locality.

Post-mortem examination of guinea-pigs inoculated in the thigh shows an intense gelatinous oedema of the subcutaneous tissue, extending as far as the anterior of the chest in many cases. There is practically no gas-formation, except occasionally a few bubbles in the subcutaneous tissue on the posterior end of the abdomen. The muscles of the leg are pale, with small hæmorrhages throughout. Organisms are seen in the muscular tissue, often only few in number. None, however, is found in the oedematous fluid or on the surface of the liver. The condition is distinct from *Vibrio septique* or *Bacillus Chauvoei*

(blackleg) infection, and could belong only to one anærobe described in gas gangrene, but rarely described as being a pathogen in domestic animals, and that one is *Bacillus oedematiens*. The work on the farm gave little room for doubt that *B. oedematiens* was the causative organism leading to death of the sheep. It produces a very powerful toxin which itself kills guinea-pigs when given subcutaneously in small doses, the oedematous swelling resulting as when the bacillus is present. Gilruth's work carried out in 1902-3 on the braxy-like disease of hoggets on turnips also gave an organism which killed guinea-pigs, with the lesions exactly similar to the Hawke's Bay disease, so that probably the same organism caused deaths in the South Island. This form of mortality, however, is very much less frequent than formerly, owing, as has been already mentioned, to the proper disposal of carcasses.

RELATED WORK IN OTHER COUNTRIES.

The description of the braxy-like disease as found in New Zealand tallies very well with the disease described by Dr. Dodd in New South Wales as "black" disease. He also found fluke present, and though he could not implicate it to the same extent as has been possible in New Zealand he believed fluke to be the primary contributing agent in the New South Wales disease. Gaiger in England and Miss H. H. Heller in the United States both considered that Dodd's black disease was caused by *Vibrio septique* and was thus a form of braxy. Both these workers based their opinion on post-mortem description alone, and not on observation of the actual organisms isolated. In April of this year Turner, working in Professor Weinberg's laboratory at the Pasteur Institute, Paris, published the result of work done in that celebrated institution on Dodd's black-disease organism. The published conclusions of these workers, which at time of writing have just come to hand, are that the causative organism is undoubtedly a strain of *B. oedematiens*. At the present moment a culture of *B. oedematiens* has been received from England for comparative tests at Wallaceville.

TENTATIVE CONCLUSIONS.

Two facts have presented themselves in this investigation. (1) The sheep are becoming infested with young flukes at the time of death; (2) necrotic areas in the liver are caused by a very toxic organism—*B. oedematiens*—and this organism is found in liver-tissue broken down by young flukes. Considerable thought has been given to the association of these two facts by both field and laboratory workers. In the field it has been noted (and several authentic cases could, if necessity arose, be given) that the disease under investigation, which could very well be named "liver necrosis of sheep," occurred very shortly after the known introduction of the liver-fluke on to the farms. One farmer, who has given great help in the present investigation, introduced fluke in locally bought sheep seven years ago, and has had deaths occurring on his farm for about six years.

Work done in connection with the life-history of the liver-fluke in Hawke's Bay is described in a separate article,* but it is easily seen by those conversant with fluke infestation of sheep that the two

* See page 175 of this issue.

conditions—fluke infestation and the mortality from this braxy-like disease—occur at the same season of the year, usually autumn and early winter. Deaths from fluke alone occur later in the spring and summer.

Until further research work has been carried out on the lines of experimental infestation of sheep with young fluke, and the simultaneous introduction of cultures of the *B. oedematiens* organism with feed, in order to ascertain whether the combination will produce a mortality, and until it has been possible to find a case unassociated with liver-fluke, it may be reasonably deduced that the liver-fluke is the introductory factor, and that *B. oedematiens* only follows in on the path of the parasite to the very favourable position in the liver where it produces toxins which kill the sheep suddenly. From the fact that the blood-stream remains sterile with regard to this bacillus it can be assumed that the infection is not blood-borne and therefore must enter through the intestinal wall. Feeding experiments with cultures of the bacillus were quite without effect. With the seasonal coincidence of fluke infestation and mortality of sheep one can then assume that the path of infection is through an injured surface of the gastro-intestinal tract. The actual path by which the fluke gains the peritoneal surface has not yet been noted, but from inflammatory areas observed it seems to be through the first part of the intestine principally.

Preventive Measures for Farmers.

The foregoing deduction being accepted as correct, the farmer must take steps to wipe out fluke in order to overcome this dangerous braxy-like mortality. Much has been written on this question, and departmental officers in Hawke's Bay are advising on the latest scientific lines as to the best methods. They are as follows:—

(1) Drainage of Swamps.

Swamps should be drained, not omitting any laterals. A good example of this latter point can be given. A sheep-farmer who has gone into the question whole-heartedly and intelligently drained his farm well, and where drainage was impossible used copper sulphate with deadly effect on the water snail. He did not, however, trouble about a few small patches on one of his creeks where a little watercress grew. During the past season a fairly heavy mortality occurred in this one paddock only, and on investigating the matter he found that areas which he thought were of little account were swarming with the water snail (*Potamopyrgus antipodum* var. *Zelandeae*), the intermediate host of the fluke. With these small areas under control he now looks confidently ahead to next season, when he expects to have only a very small loss, if any. Even this year it has been noticed on farms where drainage has been carried out thoroughly since 1926 that the losses are decreasing; but until the drains have been kept going for at least two seasons, and remaining swamps constantly top-dressed with copper sulphate to wholly eradicate the water snail, one cannot be definitely certain of the result. Two seasons are mentioned because it does not seem possible, with every known method employed, to get rid of the fluke entirely in one season.

(2) *Dressing with Copper Sulphate.*

Copper-sulphate dressing is very valuable on areas which it is impossible to drain, such as hill-country swamps in positions from which there is no fall. Broadcasting, at the rate of 28 lb. of the powdered chemical to the acre, is the best method, but spraying of a 1-per-cent. solution might do equally well. The best time for carrying out this method is still a question, but to the writer summer-time appears best, when the snails are on the surface and are producing young, rather than to treat the more resistant eggs. Then, too, the swamps are more circumscribed in summer, and can be more easily walked over. Leaving dressing till too late in the autumn means the sheep becoming infested with adult fluke before the snails are killed. A time might therefore be chosen when the hill feed is still green, but when the winter and spring water has disappeared.

(3) *Treatment of Sheep to eradicate the Adult Fluke.*

As the adult flukes pass eggs from the liver to the surface of the ground, and so to the watercress, it is advisable to get rid of these adults. The most reliable method is by using a drug which will be excreted by the liver. Two are available—extract of male-fern root and carbon tetrachloride. The latter is the more easily used and is very much cheaper. Two methods may be employed to dose the sheep: (1) By means of the drug in 1 c.c. doses shaken up in a mineral oil as a vehicle, or (2) by means of capsules. These latter are cheap, easily given to sheep in a race by dropping into the back of the mouth, and, as far as known, are harmless, and particularly effective in killing adult flukes with one dose. They are now becoming extensively used in Hawke's Bay. Young flukes which have not gained entrance to the bile-ducts are, however, not killed by this means, so that the period for using the capsules must be well chosen, and will to some extent depend upon the season. The best time theoretically would be well on in winter—say, July. The farmer, however, could dose the sheep when he gets the lambs in for marking (carbon tetrachloride having no effect on lambs), and he could dose once previously at crutching-time, the two doses costing about 2d. per head. Apart from exceptional cases, it is not advisable to dose in the summer or autumn, when the sheep are being infested, but rather to wait till the flukes have become adult.

The three foregoing methods should be used together on the farm to get rid of fluke, but where the mortality also exists it is most essential that the greatest care be exercised in the disposal of carcasses. They must be buried deeply or burned, and must not be left to rot on the ground, more especially in watercourses. Although *B. oedematiens* is found only in the liver at time of death, a few hours later it progresses all through the body of the sheep, and therefore passes into the ground in countless numbers to form a centre of danger to the flock in general.

The writer would like to record his thanks to those sheepowners who so kindly gave him information and laboratory-room on their farms. Assistance such as theirs is invaluable, and without it the present investigation would have fallen through. Acknowledgment is

also due to my colleague in all the field-work connected with this sheep mortality, Mr. E. E. Elphick, M.R.C.V.S., Departmental Veterinarian at Hastings. Mr. Elphick's article on "Liver-fluke in Sheep and its Control," published in the *Journal* for October, 1926, may also be referred to by farmers for practical information and advice.

TESTING OF NEW-ZEALAND-GROWN WHEATS.

RESULTS FOR YEARS 1926 AND 1927.

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I.—MILLING-QUALITIES.

THIS year fifty-three samples of wheat have been experimentally milled by the Chemistry Section. Twenty-nine of these were grown in the 1927 harvest, and twenty-four in the 1926 harvest. Twenty-six samples were grown at Ashburton Experimental Farm, fifteen at Lincoln Agricultural College, and twelve at Horrelville and Methven—all in Canterbury. The average yield of flour was very satisfactory, that for the 1927 harvest being slightly higher than for 1926. In general the samples from both harvests were excellent in appearance, well filled, of good uniformity, and free from weathering. No wheats were more difficult to mill than the average, while several were easier. These are indicated in the accompanying tables.

1926 Harvest Wheats (Table 1).

Queen Fair (W 160) was the best flour-yielding wheat tested from the 1926 harvest, giving 77.4 per cent. flour. If one refers to the *Journal* for June, 1924, p. 403, it will be found that Queen Fair was also the best of the miscellaneous wheats tested in that year (76.8 per cent. flour). This year (1926) the variety (X 365) gave 76.6 per cent. This series of figures for three consecutive years (76.8, 77.4, and 76.6 per cent.) is interesting and significant. This wheat, together with Yeoman (W 156), gave excellent yields of flour. The good yields which Yeoman is now producing should be carefully noted, as this wheat may possibly also possess excellent strengths under New Zealand conditions.

Solid-straw Tuscan, White-straw Tuscan, Dreadnought, Jumbuck, College Hunter's, Goldberry, Red Marvel, College Velvet, Velvet Ngapara, and Yandilla King, all grown in 1926, gave very good yields of flour. The remainder gave good to medium amounts.

1927 Harvest Wheats (Table 2).

The best wheat tested in 1927 as regards yield of flour was a sample of College Hunter's (X 369) grown at Ashburton Experimental Farm. This gave the excellent yield of 77.7 per cent. flour. Following closely was Goldberry (Hybrid W., X 370), with 77.6 per cent. flour. A sample of the same wheat (X 380) grown this year at Lincoln gave

Table I.—Milling Tests, 1926 Harvest.

Laboratory No.	Variety.	Locality.	Calculated Weight per Bushel.	Milling Test.			Remarks on Yield of Flour.
				Bran.	Pollard.	Flour.	
			lb	Per Cent.	Per Cent.	Per Cent.	
W	Queen Fair	Ashburton	63	10.4	12.2	77.4	Excellent.
160	Yeoman	"	65	10.9	12.3	76.8	Excellent ; easy to mill
156	White-straw Tuscan	Horrelville	64	12.8	11.5	75.7	Very good.
171	Dreadnought	"	62	9.4	15.0	75.6	"
258	Jumbuck	"	64	8.5	16.2	75.3	"
168	College Hunter's	Ashburton	60	12.9	11.9	75.2	"
152	Goldberry (Hybrid W)	Horrelville	64	10.7	14.1	75.2	"
172	Major	Ashburton	62	12.6	12.2	75.2	"
158	Red Marvel	Horrelville	60	11.7	13.6	74.7	"
255	College Hunter's...	"	63	12.9	12.7	74.4	"
237	Solid-straw Velvet	Ashburton	58	7.9	17.8	74.3	"
162	College Velvet	"	63	11.1	14.8	74.1	Very good ; easy to mill.
161	Velvet Ngapara	"	64	10.5	15.4	74.1	Very good.
157	Solid-straw Tuscan	"	62	11.6	14.4	74.0	Very good ; easy to mill.
256	Yandilla King	Horrelville	60	14.2	11.8	74.0	Very good.
154	Jumbuck	Ashburton	61	8.8	17.6	73.6	"
166	Marquis	"	65	12.6	14.0	73.4	Good.
259	Quality White	Methven	64	11.5	15.1	73.4	"
170	Queen Fair	Horrelville	65	11.6	15.6	72.8	"
155	Red Fife	Ashburton	61	11.1	16.2	72.7	"
254	Stand Up White	Horrelville	70	12.7	14.9	72.4	"
260	Solid-straw Tuscan	"	65	11.6	16.3	72.1	"
159	Essex Conqueror	Ashburton	64	16.2	12.3	71.5	Medium.
169	Red Fife	Horrelville	66	14.4	14.4	71.2	"

Table 2.—Milling Tests, 1927 Harvest.

Laboratory No.	Variety.	Locality.	Calculated Weight per Bushel	Milling Test.			Remarks on Yield of Flour
				Bran.	Pollard.	Flour.	
			lb.	Per Cent.	Per Cent.	Per Cent.	
X 369	College Hunter's (control)	Ashburton	63	11.8	10.9	77.7	Excellent.
370	Goldberry	"	63	10.5	11.9	77.6	"
364	Major	"	64	10.1	12.5	77.1	"
380	Goldberry	Lincoln College	65	11.3	11.4	76.8	"
382	XI/27	"	64	9.7	13.5	76.6	"
365	Queen Fair	Ashburton	64	5.9	17.5	76.6	"
363	Trifolium 14	"	60	12.1	11.5	76.4	"
375	Yeoman II	Lincoln College	63	9.1	14.5	76.4	"
383	XI/83	"	65	9.5	14.2	76.3	"
376	Biffen II	"	60	12.8	11.4	75.2	"
420	Victor	"	65	13.4	11.4	75.2	Very good
367	Essex Conqueror	Ashburton	64	11.0	14.0	75.0	"
371	White-straw Tuscan	"	65	11.5	13.6	74.9	"
384	XI/206	Lincoln College	64	11.2	13.9	74.9	Very good : easy to mill.
381	White Fife x Benefactor	"	62	11.4	13.8	74.8	"
377	Red Fife	"	60	11.8	13.5	74.7	Very good.
361	Solid-straw Tuscan	Ashburton	63	10.3	15.4	74.3	"
374	College Velvet	"	64	11.8	14.2	74.0	"
419	Pearl	Lincoln College	66	13.8	12.4	73.8	"
366	Marquis	Ashburton	66	8.6	17.9	73.5	"
373	College Hunter's, 1926	"	64	12.0	13.6	73.5	"
441	" Mixture "	"	..	13.0	13.5	73.5	"
379	Bell	Lincoln College	58	11.6	15.0	73.4	"
378	Tuscan	"	62	11.2	16.3	72.5	Good : easy to mill.
421	College Hunter's	"	66	7.9	19.8	72.3	Good.
372	Velvet x Solid-straw Tuscan	Ashburton	62	11.2	16.9	71.9	"
368	Yeoman	"	64	14.8	13.5	71.7	"
362	Red Fife	"	65	9.2	19.4	71.4	Medium.
418	Hunter's	Lincoln College	64	10.0	19.2	70.8	"

76.8 per cent. flour. Last year a sample of the same variety gave 75.2 per cent. flour, while the yield was 77.3 per cent. in 1925 and 75.6 per cent. in 1924. There can be no doubt that Goldberry as a rule produces an excellent percentage of flour. Incidentally these consistent yields give an indication of the reliable results that may be obtained from efficient experimental milling. It can be no accident that Goldberry over a series of years has given such a very good flour-yield, but rather the result of essential characteristics manifesting themselves during reasonable experimental milling tests. The strength, or baking-quality, of Goldberry remains to be established.

There are several little-known varieties among the 1927 wheats, as well as two crossbred wheats in the experimental stage, which give excellent yields of flour. A sample of Yeoman II grown at Lincoln is conspicuous with the excellent yield of 76.4 per cent. flour. This is a very encouraging yield, and agrees closely with the sample of Yeoman grown at Ashburton in 1925, which gave 76.8 per cent. flour. This latter flour (W 156), as far as behaviour in the mill and general appearance of the flour goes, was probably the best flour for strength tested in 1926 and 1927.

Among the wheats from the 1927 harvest giving very good yields was the variety Biffen II, from Lincoln College, with 75.8 per cent. flour. Victor, producing 75.2 per cent., is no exception to the rule that this variety may generally be expected to give a good yield of flour; it usually fails, however, in baking-qualities.

Other interesting varieties giving good yields of flour are Essex Conqueror, Red Fife, Velvet, Pearl, and Marquis, all wheats which may also be expected to produce flour of good baking-strength. Those wheats producing less than 72.5 per cent. flour in 1927 may be classified as good to medium, none giving less than 70.0 per cent. flour.

Averages.

The averages for the different districts were as follows :—

	Per Cent. Flour		Per Cent. Flour.
1926—Ashburton	.. 74.4	1927—Ashburton	.. 74.7
“ Horrelville, &c.	.. 73.9	Lincoln College	.. 74.5

There was a certain tendency, not reflected in the above figures, for the 1927 wheats to give higher flour-yields, nine of the twenty-nine tested being classified as excellent, compared with two of the twenty-three grown in 1926.

Low Temperature Research.—The successful marketing of Empire produce from overseas depends upon no single factor more than upon the skilful development of cold-storage processes (states a recent report of the Empire Marketing Board, London); and research into these processes is also of great importance in its bearing upon the keeping-qualities of the produce of the home supplier. The Low Temperature Research Station at Cambridge under the auspices of the Department of Scientific and Industrial Research has already made contributions to this development which have been gratefully recognized throughout the Empire and which point to invaluable opportunities for their extension. The Board has accordingly approved a substantial grant for the extension of this station at Cambridge, and has given provisional approval to a scheme for the erection of a new station at East Malling, Kent, for cold-storage experiments on a semi-commercial scale.

PASTURE-IMPROVEMENT.

TOP-DRESSING EXPERIMENTS WITH POTASH AND NITROGEN IN AUCKLAND PROVINCE.

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To state that grassland is the mainstay of the New Zealand farmer is only stressing the obvious. The truth of the statement, however, is exemplified more in the North Island than in the South Island, where cereal production and other cash crops occupy an important place in farming. It is particularly true of the northern portion of the North Island, where, with the exception of cob maize, the farmer is dependent almost wholly on his pastures.

In order to establish and maintain good grassland the application of phosphatic manures to the soil is essential. This fact is fairly widely recognized, though manuring of grassland is not so widely practised as is generally supposed. Even in the Auckland Province, where the main crop is overwhelmingly grass, only about one-fifth of the area in grass is regularly top-dressed with fertilizer. This estimate was made recently, and was arrived at after calculating the total amount of phosphate used in the province for top-dressing, and allowing that on the average a dressing of 2 cwt. per acre was applied annually.

In districts where intensive dairying is the main type of farming followed, top-dressing with phosphatic fertilizers is a regular practice. Except on the best soils, much of the country which is now giving profitable returns would not be in first-class pasture were it not for the fact that phosphatic manures have built up soil-fertility so that such a pasture can be maintained.

The sure place now occupied in farming practice by phosphatic top-dressing of grassland, especially in the dairying districts, has attracted the attention of farmers on the wider areas where grazing of sheep and cattle is the chief occupation and the demands on the soil are relatively less than on more intensively farmed country. On these lands the response to phosphates is very marked, and no doubt the good results already attained during the last two or three years will tend to make top-dressing as indispensable to their profitable farming as on the dairying-lands. Farmers have hitherto been relying on the virgin fertility of the soils on the sheep and cattle country, but the natural reserves are certainly showing clear signs of depletion, with deterioration of the pastures, which in turn causes a lowering of the carrying-capacity, followed by diminished returns.

The Department of Agriculture has accumulated a mass of useful information from soil-analysis, from systematic field experiments, and from the experience of farmers in the use of fertilizers on grassland. The comparative values of different phosphates on the market have been widely tested, and fairly definite advice can be given on the use of the different kinds. But the case for fertilizers supplying potash and nitrogen has not been worked out. The opinion has been widely held that nitrogen is not necessary for grassland, as it was considered

economically sound to increase clover-growth by the use of phosphates, the clovers in their turn supplying available nitrogen to be absorbed by the grasses. The recent German experiments on grassland have shown that direct feeding of grasses with nitrogen may be highly profitable. The position taken up is, If nitrogen supplied indirectly by the clovers is so good for the grasses, why not supply the nitrogen direct to the grasses?

Plan of the Auckland Experiments.

In the Auckland Province a series of field experiments have been designed to test this proposition on an economic basis. Trials, using green-weight increases on small-scale plots established in different parts of the province, are being made. In addition a small farm of 50 acres at Manawaru, near Te Aroha, running a milking-herd of thirty dairy cows, is being dressed with sulphate of ammonia, and the measure of improvement in this case will be the increase or otherwise of milk and butterfat returns from the herd over a number of seasons. Similar experiments have been established to test potash. In both cases phosphates, with and without lime, form the basis of the manuring.

These experimental plots are all situated on soils which have been heavily manured with phosphates for many years—up to ten and even twenty years. The contention is that if potash or nitrogen is a limiting factor these soils should tend more to show this fact than other soils not so treated. The trials dealt with in this report refer to Maunu, near Whangarei. Matangi, near Hamilton; and Te Aroha.

The manures used were as follows, the quantity per acre being stated in each case:—

- (1) Superphosphate (44/46 per cent.), 3 cwt.
- (2) Superphosphate (44/46), 3 cwt., plus sulphate of potash, $\frac{3}{4}$ cwt.
- (3) Superphosphate (44/46), 3 cwt., plus dried blood, $\frac{3}{4}$ cwt.

A fourth plot was left unmanured.

The plots were laid down the width of the manure-drill—8 ft. or 9 ft. wide—along the field for a distance of 6 chains. A cross-dressing of 5 cwt. of carbonate of lime per acre was applied at 1-chain intervals, so that the effect of the manures on limed and unlimed pasture could be noted. There were six replications of each treatment, giving twenty-five plots in all.

The plots were closed during the haying season of 1926, and, when cut, a uniform swath was taken along the centre of each plot for a distance of $\frac{1}{3}$ chain, and the green material weighed. Each weighing therefore represents the amount of herbage from $\frac{1}{315}$ acre. The weight per acre has been expressed as tons of hay, by taking the hay weight as being one-third of the green weight.

Farm of F. O. Barge, Maunu.

Soil: Medium volcanic loam; lime-requirement, 4.2 tons per acre (Hutchinson and McLennan method); total phosphoric acid, 0.17 per cent. (top soil dried at 100°C.); available phosphoric acid, 0.018 per cent. Pasture: Cocksfoot, rye-grass, and white clover, with a

certain amount of paspalum and ratstail. History of field: Sown to grass in 1920, with 3 cwt. per acre of equal parts super and blood and bone; in 1922 top-dressed with 2 cwt. super and 1 cwt. lime per acre; 3 cwt. super in 1925. Cut for hay in 1925.

The manures for the present experiment were applied 8th July, 1926, and the field was closed for hay during August. There was no visible difference in appearance of the plots during the growing-period. The crop was cut on 6th December, 1926. Results are shown in the following table:—

Table 1.—Results, F. O. Barge's Farm, Maunu.

Comparison, A versus B.	Number of Compared Plots.	Weight expressed as Tons of Hay per Acre.	Difference in Favour of A (Tons).	Difference Significant (S.) or Non-significant (N.S.).	Cost of Manures (f.o.r. Prices)
<i>Unlimed Plots.</i>					
A. Super	24	4.133	0.305	S.	£ s. d. 0 16 10
B. Control .. ..	..	3.828	..	..	..
A. Super and potash	24	4.175	0.346	S.	1 8 1
B. Control .. ..	..	3.829	..	..	..
A. Super and blood	24	4.183	0.198	S.	1 7 9
B. Control .. ..	..	3.985	..	..	..
A. Super and potash	24	4.262	0.124	N.S.	1 8 1
B. Super .. ..	..	4.138	..	..	0 16 10
A. Super and blood	24	4.115	0.28	N.S.	1 7 9
B. Super .. ..	..	4.087	..	..	0 16 10
<i>Limed Plots.</i>					
A. Super	24	4.189	0.198	S.	0 16 10
B. Control .. ..	..	3.991	..	..	..
A. Super and potash	24	4.188	0.198	S.	1 8 9
B. Control .. ..	..	3.990	..	..	..
A. Super and blood	24	4.317	0.429	S.	1 7 9
B. Control .. ..	..	3.888	..	..	..
A. Super and blood	24	4.174	0.46	N.S.	1 7 9
B. Super .. ..	..	4.128	..	..	0 16 10
A. Super	24	4.244	0.69	N.S.	0 16 10
B. Super and potash .. ..	..	4.175	..	..	1 8 9

NOTE.—A difference is regarded as "significant" when the chances (computed by the statistical method) are 30 to 1 or more in its favour.

It will be seen from the table that all the treatments have given substantial weight-increases over no manure, but when the treatments are compared each with the other the differences thus revealed are not statistically significant. In other words, the differences may not be real and due to the effect of the manures. It cannot be said, therefore, with any certainty that any one treatment is better than another at this stage of the experiment, but it would appear that neither the

addition of potash nor of blood to the phosphate has caused any measurable increase in the weight yield.

According to the chemical analysis taken before the dressings were applied, this soil was deficient in available phosphates and only moderately supplied with total phosphates, and it may be that the manuring of the field with phosphates has not reached that stage when it can be supplemented to advantage by the addition of nitrogen or potash.

The aftermath was inspected at various times after cutting, and, although the top-dressed plots were practically indistinguishable one from the other, the check plots showed generally more bare spaces, more weeds of the catsear and hawkweed type, and less clover than the adjoining plots. It was also noticed that a preference was shown by the stock for the limed areas irrespective of the top-dressing used.

Farm of J. A. Clothier, Hungahunga (Te Aroha).

Soil: Consolidated silty peat, overlying heavy clay; lime-requirement, 7.3 tons per acre (Hutchinson and McLennan method); total phosphoric acid, 0.08 per cent.; available phosphoric acid, 0.018 per cent. History of field: Sown to grass in 1923; cut for hay in 1924; top-dressed with $2\frac{1}{2}$ cwt. super per acre in 1924 and 1925.

The manures for the present experiment were applied on 13th September, 1926, the pasture at that time being composed mainly of perennial rye-grass, cow-grass, timothy, and white clover. The crop was cut for hay on 19th January, 1927, and up to the time of cutting there was no marked difference of the herbage in the various plots. Results of the weighings are set out in Table 2. (See next page.)

All the manures, it will be observed, have given increases when directly compared with no manure, and the increase is so appreciable that each treatment repaid the cost of application. An outstanding feature of the results, however, is the increase given by the addition of potash to the phosphatic dressing on the unlimed plots. The increase apparently due to the same manuring on the limed plots is not significant, the odds in favour of the difference being less than 30 to 1, and therefore such increase cannot, with practical certainty, be regarded as being due to the manurial treatment. The soil-analysis indicated that this soil was deficient in total phosphate, yet well supplied with available phosphate. The indicated lime-requirement was very high indeed.

The favourable response to potash in this experiment supports the claim that peat soils need that constituent and respond to applications of it. The application of lime on the peat soil gave a favourable result on all the plots. When treatments are compared, therefore, on the limed areas it will be seen that the influence of the lime has somewhat masked the increase due to potash. In other words, the potash does not appear to have asserted itself so much in the limed as in the unlimed plots; but this can be understood when due allowance is made for the good effects brought about by the lime.

When the aftermath was examined on 24th February the check plots could be easily distinguished, standing out as golden strips of flowering catsear and hawkbit. As the herbage consisted mainly of

Table 2.—Results on J. A. Clothier's Farm, Hungahunga.

Comparison, A versus B.			Number of Compared Plots.	Weight expressed as Tons of Hay per Acre.	Difference in Favour of A (Tons).	Difference Significant (S.) or Non-significant (N.S.).	Cost of Manures (f.o.r. Prices).
<i>Untimed Plots.</i>							
A. Super	..	..	24	2.265	0.273	S.	£ s. d. 0 16 10
B. Control	..	..	..	1.992	..	..	..
A. Super and potash	..	..	24	2.325	0.383	S.	1 8 1
B. Control	..	..	..	1.942	..	..	..
A. Super and blood	..	..	24	2.315	0.415	S.	1 7 9
B. Control	..	..	..	1.900	..	..	..
A. Super and potash	..	..	24	2.574	0.258	S.	1 8 1
B. Super	..	..	..	2.316	..	..	0 16 10
A. Super	..	..	24	2.214	0.009	N.S.	0 16 10
B. Super and blood	..	..	..	2.205	..	..	1 7 9
<i>Limed Plots.</i>							
A. Super	..	..	24	2.413	0.314	S.	0 16 10
B. Control	..	..	..	2.099	..	..	..
A. Super and potash	..	..	24	2.433	0.293	S.	1 8 1
B. Control	..	..	..	2.140	..	..	..
A. Super and blood	..	..	24	2.454	0.364	S.	1 7 9
B. Control	..	..	..	2.090	..	..	..
A. Super	..	..	24	2.385	0.069	N.S.	0 16 10
B. Super and blood	..	..	..	2.316	..	..	..
A. Super and potash	..	..	..	2.572	0.132	N.S.	1 8 1
B. Super	..	..	..	2.436	..	..	0 16 10

cow-grass there was no great difference between the remaining plots, except that the potash plots appeared to be more vigorous and of better colour, and it was noticed that on the first grazing the dairy cows showed a preference for them. The limed plots gave noticeable increases in clover-growth over the check plots.

Farm of W. Ranstead, Matangi.

Soil: Pumiceous loam; lime-requirement, 4.8 tons per acre (Hutchinson and McLennan method); total phosphoric acid, 0.17 per cent.; available phosphoric acid, 0.018 per cent. Pasture: Ryegrass, cocksfoot, crested dogtail, and white clover. History of field: Old pasture; had been top-dressed for seven years at least with 2 cwt. to 3 cwt. of either super or basic super.

The manures for the present experiment were applied on 19th July, 1926. The field was closed for hay in September, and cut on 14th and 15th December. At the time of cutting the check plots could be distinguished from the manured plots quite easily on account of their brown appearance, due to the less amount of clover in the herbage and a greater proportion of rib-grass.

The following table gives the results : —

Table 3.—Results on W. Ranstead's Farm, Matangi.

Comparison, A versus B.			Number of Compared Plots.	Weight expressed as Tons of Hay per Acre.	Difference in Favour of A (Tons).	Difference Significant (S.) or Non-significant (N.S.).	Cost of Manures (f.o.r. Prices).	
<i>Unlimed Plots.</i>							£	s. d.
A. Super	..	..	20	3.298	0.217	S.	0	16 10
B. Control	..	..	..	3.191	..	..	..	..
A. Super and potash	..	..	20	2.952	0.166	N.S.	1	8 1
B. Control	..	..	..	2.786	..	..	..	..
A. Super and blood	..	..	25	3.321	0.447	S.	1	7 9
B. Control	..	..	..	2.874	..	..	..	..
A. Super and potash	..	..	25	3.413	0.067	N.S.	1	8 1
B. Super	..	..	..	3.346	..	..	0	16 10
A. Super and blood	..	..	20	2.752	0.125	N.S.	1	7 9
B. Super	..	..	..	2.627	..	..	0	16 10
<i>Limed Plots.</i>								
A. Super	..	..	30	2.925	0.360	S.	0	16 10
B. Control	..	..	..	2.555	..	..	..	..
A. Super and potash	..	..	24	2.791	0.350	S.	1	8 1
B. Control	..	..	..	2.440	..	..	..	..
A. Super and blood	..	..	30	3.095	0.277	S.	1	7 9
B. Control	..	..	..	2.818	..	..	..	..
A. Super and potash	..	..	30	3.376	0.364	S.	1	8 1
B. Super	..	..	..	3.012	..	..	0	16 10
A. Super	..	..	24	2.514	0.002	N.S.	0	16 10
B. Super and blood	..	..	..	2.512	..	..	1	7 9

The figures show that super plus potash has failed to give any significant increase over no manure on the unlimed plots, but, except for this, all the manures have given good results when compared with no manure. Moreover, the addition of potash to super has given a significant weight-increase over superphosphate alone on the limed plots. This is diametrically opposed to the results secured at Hungahunga. Further trials may clear up this matter.

An examination of the field a few weeks after cutting revealed the fact that the check plots stood out from the rest on account of the seed-heads of rib-grass. Of the manured area the potash plots were grazed the more evenly and closely, while the blood plots showed a good deal of top which had been neglected. When an inspection was made during the winter the limed plots were looking much better than the unlimed, chiefly on account of the white-clover content; and the same observation could be applied to the treated plots when compared with the checks.

General Comments.

While the foregoing results were obtained within five months of treatment, and as yet no definite general conclusions can be drawn, there are a few facts which may be commented upon.

A nitrogenous dressing is generally claimed to stimulate growth and to give greater bulk, especially when applied in spring to the hay crop. Yet at each centre nitrogen in the form of blood has failed to give any appreciable increase. The complete test of these manurial treatments, however, may come later on, when, after further dressings, any change in the herbage has been observed. At two places potash added to the superphosphate has given good results in the first year, and it will be noted that at each of them the soil, according to analysis, was relatively high in the amount of available phosphate prior to the manures being applied. Further, chemical analysis showed that the soils were well supplied with potash.

In every case, with the exception of super and potash on the unlimed plots at Matangi, the pastures have been responsive to the various treatments, and in most cases the increase has been sufficient to cover the cost of the manures. Yet the most striking results were seen in the aftermaths, when, after a few weeks from the time of cutting, the check plots were masses of flowering weeds. It would appear that under ordinary circumstances, when a pasture is closed for hay, those weeds of the catsear type which are not shade-loving and are kept subdued by the hay crop assert themselves on the shady conditions being removed. Yet spring top-dressing seems to prevent this, probably on account of the increased clover content of the pasture "bottom."

These experiments will be continued during the next season as far as possible, and it is to be hoped that further useful data will be obtained from the composition of the herbage as well as from the hay weights.

We tender thanks to Messrs. Barge, Clothier, and Ranstead for their valuable co-operation with the Department. We also acknowledge the help given by Mr. A. H. Cockayne, Director of the Fields Division, in planning the trials, and by other members of the Division in securing the experimental results.

Deficiency Diseases of Live-stock.—The Empire Marketing Board remarks in a recently issued report: "One of the gravest yet most obscure handicaps to the rearing of flocks and herds in several parts of the Empire is the deficiency of minute quantities of mineral salts in their pastures. This lack hinders the growth of animals, and even causes them to perish from malnutrition. Following pioneer work done in various parts of the Empire—and notably in South Africa—research into this question, the importance of which was brought to the Board's notice at an early stage by the Committee of Civil Research, is already being pursued upon a concerted plan, with funds provided partly from the Empire Marketing Fund and partly from local public or private sources, at the Rowett Institute, Aberdeen, in the highlands of Kenya, in New Zealand, and in Australia. No better example could be offered of the value of scientific 'team work' throughout the Empire."

MARTON EXPERIMENTAL AREA.

NOTES ON OPERATIONS, 1926-27 SEASON.

J. W. DEEM, Instructor in Agriculture, Wanganui.

THE early part of the season at Marton was very wet, preventing agricultural operations being carried out in a satisfactory manner. Good seed-beds could not be prepared on the heavy soil of the Experimental Area, and sowing had to be done under very difficult conditions; portions of areas sown in cereals were subsequently swamped out by heavy rainstorms. About New Year the weather took up, and harvest operations were conducted under very satisfactory conditions for this district. The rainfall for the year was as follows:—

Table 1

Month.	Number of Wet Days.	Month's Rainfall.	Average Rainfall, 1916 to 1927.	Month.	Number of Wet Days	Month's Rainfall.	Average Rainfall, 1916 to 1927.
1926.		In.	In.	1927.		In.	In.
July ..	10	5.57	39.68	January ..	10	2.22	40.45
August ..	11	3.75	39.40	February ..	8	2.58	40.21
September ..	9	2.86	40.02	March ..	14	4.82	40.61
October ..	18	8.17	38.57	April ..	12	3.52	40.34
November ..	15	5.38	40.10	May ..	11	3.90	40.34
December ..	8	3.18	40.50	June ..	14	3.50	40.51

Arable Crops.

The growing of cash crops is being gradually reduced at the Marton Area, each year more of the land being devoted to experimental work with grasses, clovers, and pasture top-dressing. The total area under crop in the 1926-27 season was 20 acres, 5 acres of this being in oats, 8 acres in wheat, 2 acres in barley, and 5 acres in swedes and chou moellier.

Cereals.

The wheat variety grown was Jumbuck, and, although large patches were drowned, it threshed out at the rate of $34\frac{1}{2}$ bushels to the acre. This wheat does well in the Marton district, but suffers from birds.

One bushel of Spratt Archer barley, selection 37/6, was procured from England through the courtesy of Captain H. Hunter, School of Agriculture, Cambridge. This was sown on $\frac{1}{3}$ acre on 28th September, 1926, harvested 4th February, 1927, and threshed out of stook on 17th February, yielding $22\frac{1}{2}$ bushels, or at the rate of $68\frac{1}{2}$ bushels per acre, of very nice quality barley. The germination was fair, and the plants stood well. Portion of this barley has been sent to the Fields Division at Christchurch, to be further tested out in Canterbury. The rest will probably be sown on the Marton Area in the season now commencing.

The oat crop consisted of a test between College Algerians and ordinary South Island and Australian Algerians. The College strain stooled out best, and appeared to give the better crop right through. The material from each area was stacked separately for cutting into chaff, but up to date of writing this has not been done.

Swedes.

A test was made of seventeen varieties. The crop was sown on 22nd December in drills 28 in. apart, thinned and intercultivated, the manuring being superphosphate at 3 cwt. per acre. The field on which the crop was grown is very stiff land, and was very wet right up to and for two or three weeks after sowing, when an acute dry spell set in and the soil set very hard. Consequently the crop did poorly and the yields were light. No swedes in the locality did well. The crop was weighed on 18th May, with the following results:—

Table 2.

Variety.	Number of Roots per Chain.	Weight per Acre.	Remarks.
		T. cwt.	
Studsgaard Itamme..	76	10 12	2 per cent. of club-root ; quality poor.
Hernsnaps Itamme ..	84	11 2	No disease ; roots small, but cut sound
Family No. 4 ..	76	13 18	No disease ; when cut going dark in centre.
Wibolt's Danish Giant	64	21 4	Very sound roots ; cut well.
Bangholm Klank ..	72	17 8	No disease ; quality fair ; cut very nicely.
Sutton's A. . .	76	18 3	No disease ; a few nodular roots ; cut well.
Sutton's B. . .	64	23 4	No disease ; roots well grown, a few with slight nodular growth ; cut well.
Sutton's C. . .	56	17 3	No disease ; roots rather long shape ; cut very nicely
Bangholm Pajbjerg	81	16 13	No disease ; cut very nicely.
Sharpe's Great Scott	72	13 18	No disease ; cut nicely and clean ; very yellow.
Sharpe's Supreme ..	76	21 4	Green top ; sound, and cut well.
Sharpe's Paragon ..	88	29 16	Rather white flesh ; sound ; cut very nicely.
Sharpe's A1 ..	88	25 15	No disease, but going off in centre.
Sharpe's Ne Plus Ultra	80	29 16	Going off a bit in centre, otherwise sound
Sharpe's Coronation	84	15 3	Light-green top ; no disease.
Sharpe's Standard ..	80	17 13	20 per cent. of club-root ; sound roots cut well.
Sharpe's Premier ..	56	21 4	Well-grown roots, but showing dark in centre when cut.

A small manurial experiment was also carried out with swedes to test the proprietary fertilizer Sulfurophosphate against superphosphate, the rate in each case being 3 cwt. per acre. The seed was sown in drills 28 in. apart, thinned, and intercultivated. Two varieties of swedes were used, and weights were taken on 16th May. Results are shown in the following table:—

Table 3.

Variety.	Manure.	Number of Roots per Chain.	Weight per Acre.	Remarks.
Bangholm	Superphosphate	81 (average root, 1.63 lb.)	T. cwt. 17 8	Roots cut nicely; no disease.
Fajbjerg	Sulfurophosphate	63 (average root, 1.9 lb.)	15 15	No disease; roots cut nicely; one or two showing slight nodular growth.
Ditto				
Bangholm	Superphosphate	72 (average root, 2 lb.)	16 13	No disease; cut well; crop light.
Klank	Sulfurophosphate	80 (average root, 1.44 lb.)	15 8	Roots rather smaller than superphosphate lot; no disease; cut well.
Ditto				

It will be noticed that the germination was about equal, but superphosphate gave the heavier crop; no disease was present.

Clovers and Grasses.

The areas under clover tests have been extended, and now comprise various strains of both white and red clovers. In the white clovers the supremacy of imported wild white and Canterbury white over ordinary imported white is more apparent than ever. The two former have now grown into a close sward, covering the whole of the ground and producing green succulent fodder practically all the year round; while the area sown with ordinary imported has become very patchy, showing large patches of water-couch and other inferior herbage, and not producing anything like the amount of fodder yielded by the Kentish imported and the Canterbury. If it were not for the fact that the ordinary imported reseeds itself to some extent, the area sown in it would be carrying very little. This clover rushes up to flower rapidly and matures a quantity of seed, then for quite a long period is more or less dormant, producing practically no feed. The Canterbury white flowers about three weeks later than the ordinary, and taking 100 as the percentage of flowering on the ordinary imported the percentage on the Canterbury would be in the vicinity of 30 per cent., while in the imported wild white it would not be more than 10 per cent., and only a small proportion of this appears to set seed. During the past two seasons an endeavour has been made to secure seed from the imported wild white, but owing to its shyness in flowering we have not been successful.

An area has also been sown down in perennial rye-grass, 15 lb.; cocksfoot, 6 lb.; and imported wild white clover, 3 lb. per acre, to test the value of this mixture for permanent pasture. On half the area very-old-pasture Hawke's Bay rye-grass seed was used, and on the rest, standard Canterbury. This will provide an experiment to determine the lasting-value of old-pasture rye-grass seed, costing 12s. per bushel, against the standard at 6s.

A 10-acre field has been sown in red clover and rye-grass to test out the feeding and lasting qualities of ordinary imported red clover, New-Zealand-grown, Vale of Clywd, Cornish Marl, and genuine Montgomeryshire late-flowering red. Five acres were sown on 8th April,



FIG. 1.—CLOVER AREAS. SHOWING DIFFERENCE BETWEEN NEW ZEALAND WHITE (LEFT) AND ORDINARY IMPORTED WHITE (RIGHT).



FIG. 2.—CLOVER AREAS, SHOWING DIFFERENCE IN FLOWERING BETWEEN IMPORTED WILD WHITE (LEFT) AND NEW ZEALAND WHITE (RIGHT).

[Photos by H. Drake.

1926, and the sowings repeated on the adjoining 5 acres on 24th November. All the clovers, with the exception of ordinary imported red, came away well. The latter established poorly as compared with the others, both in the autumn and spring sowings, although the seed sown had given a laboratory test of over 90 per cent. germination. The Montgomeryshire red and Vale of Clywd appear to be very similar, both varieties having a definite spreading habit and being fully six weeks later in flowering than the ordinary imported and New-Zealand-grown varieties. Owing to this lateness in flowering the Montgomeryshire red and Vale of Clywd have a much longer growing-period and appear to produce a great deal more feed. During the past winter these two varieties have grown more or less right through, and provided quite a lot of fodder. To the casual observer the area under these clovers, when compared with the area under ordinary red, would suggest that the former had been heavily dressed with fertilizers and the latter left untreated. As a matter of fact, the whole field has been treated in exactly the same manner. Further supplies of Montgomeryshire late-cut clover-seed are under order, and it is proposed to sow additional areas in this clover during the present season. It is also hoped that some seed will be saved from the present area next autumn.

Small plots of pure sowings of the various clovers and rye-grasses under test have also been established, also plots of several new strains of other grasses, including a plot of *Phalaris stenoptera* from seed imported from America by Mr. W. J. Polson, president of the New Zealand Farmers' Union. Several New Zealand specialists who have examined this grass declare that it is identical with a grass that has been grown in New Zealand for a number of years under the name of *Phalaris bulbosa*, or Harding grass.

Pasture Top-dressing.

The experiments referred to in last year's report (*Journal*, August, 1926) have been continued, and a further series have been laid down to test Seychelles guano against superphosphate with and without muriate of potash; also to test Seychelles guano, finely ground and standard Nauru phosphate, Sulfurophosphate, basic slag, and superphosphate against one another. Some of the 1926-27 results are very interesting. Table 4 gives the results, in weight of green material, of five cuts for hay in Field 4 to test ordinary against finely ground Nauru phosphate; Table 4a records a test between super, Nauru, and Nauru plus sulphur.

Table 4.

Treatment per Acre.	Total Yield per Acre (Five Cuts).	Total Yield per Acre from Adja- cent Controls	Increase due to Manure.
Ordinary Nauru phosphatic, 80 per cent. fineness, 3 cwt.; applied 6/6/24 and 28/5/26	T. cwt. 38 3	T. cwt. 33 5	T. cwt. 4 18
Special Nauru phosphate, 120 per cent. fineness, 3 cwt.; applied 6/6/24 and 28/5/26	38 4	33 19	4 5

Table 4a.

Treatment per Acre.	Total Yield per Acre (Five Cuts).	Total Yield per Acre from Adjacent Controls	Increase due to Manure.
	T. cwt.	T. cwt.	T. cwt.
Superphosphate, 3 cwt. ; 20/9/24 and 28/5/26 ..	37 1	31 17	5 4
Nauru phosphate, 3 cwt. ; 20/9/24 and 28/5/26	34 13	30 7	4 6
Nauru phosphate, 3 cwt., and sulphur, 84 lb. ; 20/9/24 and 28/5/26	34 2	29 15	4 7

From Table 4a it will be seen that super has given slightly better results than Nauru, but this was due to increased yields in the first two seasons. In 1926-27 the Nauru gave a little better increase than super. It will also be noticed that the application of sulphur in combination with Nauru apparently had no effect on the yield.

The results of a test between Rhenania phosphate, basic slag, and superphosphate are given in the next table :—

Table 5.

Fertilizer.	Date applied.	Yield per Acre (Green Weight).
Rhenania phosphate, 2 cwt. per acre	29/5/26	Tons. 9.80
Basic slag, 2 cwt.	29/5/26	9.94
Superphosphate, 2 cwt.	28/7/26	9 55

The weights, it will be seen, are about equal. Rhenania phosphate represents an attempt to produce an artificial slag, and contains 25 per cent. phosphoric acid. Cross-sections of this field were top-dressed with 30 per cent. potash salts at 1 cwt. per acre. The average weight from the areas that had potash works out at 9.63 tons per acre, while those that had no potash average 9.80 tons, or 0.174 tons in favour of no potash. This difference is not significant, but goes to further substantiate the previous findings that potash has no effect on the weight of material grown on this farm. It may, of course, improve the quality.

Brice's Section, Field 3a.

This area consists of some town sections that have been in grass for over thirty years. When taken in hand in 1921 the land was carrying a poor covering of *Agrostis stolonifera* (water-couch), and producing practically nothing, whereas at the present time the top-dressed pastures are first class and would carry from three to four sheep per acre, while the control would carry about 1 sheep and do it very poorly. Table 6 gives the manures that have been applied since 1921, their cost, and the weight of grass from one cut per year for the past three years. It will be noticed that the Nauru phosphate in trial No. 7 shows much poorer results than in 2, 3, and 4. There is a doubt about the material of the first application. Although supplied as Nauru phosphate, we surmise that it must have been a mixture of half Nauru

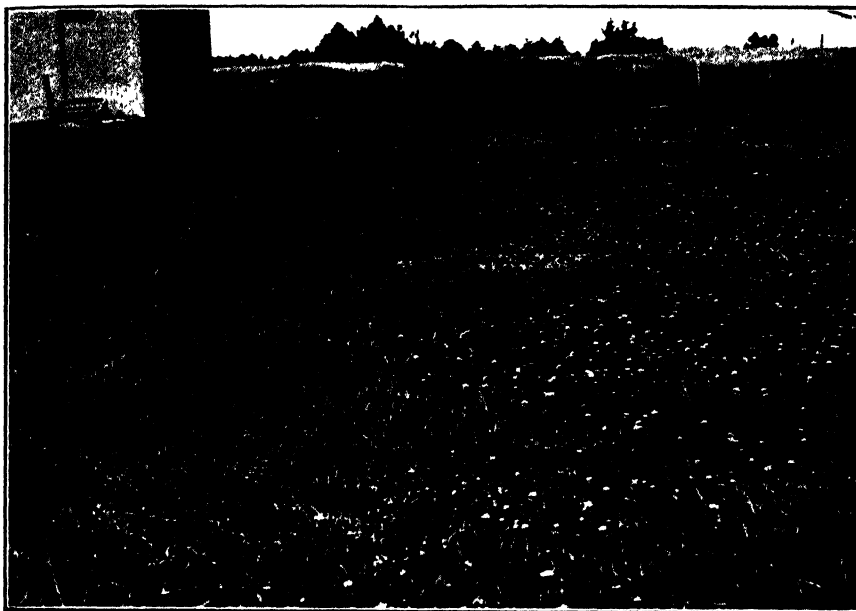


FIG. 3.—TOP-DRESSED PASTURE PLOTS IN FIELD 3A.
Nauru phosphate on right ; control (no manure) on left.

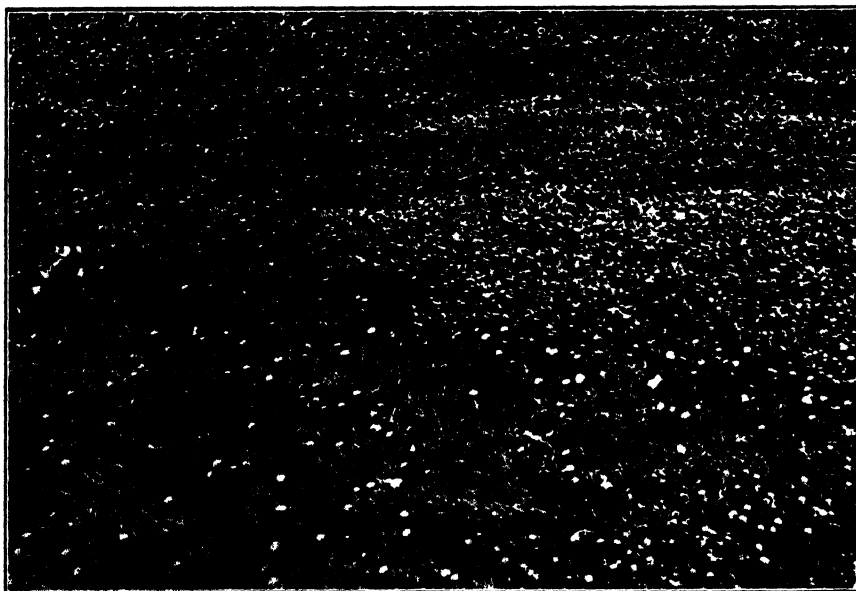


FIG. 4. — TOP-DRESSED PLOTS IN FIELD 4A.
Lime and super on right ; control on left.

and half finely ground carbonate of lime, and as the latter has a depressing effect on the action of Nauru this might account for the poor showing on this area.

Table 6.

Treatment per Acre.	Total Green Weight (Three Years).	Increase over Control.	Cost of Treatment.		
	T. cwt.	T. cwt.	£	s.	d.
(1) Lime, 1 ton, 9/8/21; super, 2 cwt., 9/8/21, 11/8/24, 28/5/26	19 18	16 2	2	16	0
(2) Bone char, 4 cwt., 9/8/21; special Nauru, 4 cwt., 11/8/24, 28/5/26	14 9	10 13	3	12	0
(3) Walpole Island phosphate, 4 cwt., 9/8/21; Nauru phosphate, 4 cwt., 11/8/24, 28/5/26	14 3	10 7	3	12	0
(4) Nauru phosphate, 4 cwt., 2/11/22, 11/8/24, 28/5/26	14 3	10 7	3	12	0
(5) Control (no manure)	3 16	..	..	..	..
(6) Basic slag, 4 cwt., 14/7/21, 11/8/24, 28/5/26	12 15	8 19	3	18	0
(7) Nauru phosphate, 4 cwt., 14/7/21, 11/8/24, 28/5/26	9 18	6 2	3	12	0
(8) Ephos phosphate, 4 cwt., 14/7/21, 11/8/24, 28/5/26	10 8	6 12	4	4	0

Moss's Section, Field 4a.

This area consists of several acres of town sections that have been down in pasture for over thirty years, and, like the control in Field 3A, carried a poor covering of *Agrostis stolonifera* when taken in hand two years ago.

The following table gives details of hay weights :—

Table 7.

Treatment per Acre.	Hay Weight per Acre (Two Years).	Hay Weight per Acre of Adjacent Controls.	Increase.	Cost of Treatment.			Cost per Ton of Increase.		
	T. cwt.	T. cwt.	T. cwt.	£	s.	d.	£	s.	d.
Lime, 1 ton, applied 27/7/25 ..	1 14	1 12	0 2	1	0	0	..	..	..
Lime, $\frac{1}{2}$ ton, 27/7/25 ..	1 15	1 11	0 4	0	10	0	..	..	..
Lime, $\frac{1}{4}$ ton, 27/7/25; super, 3 cwt., 27/7/25, 28/5/26	6 2	1 6	4 16	2	9	0	0	10	2 $\frac{1}{2}$
Super, 3 cwt., 27/7/25, 28/5/26 ..	4 18	1 14	3 4	1	19	0	0	12	3 $\frac{1}{2}$
Basic super, 3 cwt., 27/7/25, 28/5/26	3 13	1 17	1 10	1	16	0	1	0	0 $\frac{1}{2}$
Slag, 3 cwt., 27/7/25, 28/5/26 ..	5 17	1 10	4 6	1	16	0	0	8	3
Nauru, 3 cwt., 27/7/25, 28/5/26 ..	5 1	1 14	3 7	1	16	0	0	10	3 $\frac{1}{2}$
Super, 1 $\frac{1}{2}$ cwt.; blood and bone, 1 $\frac{1}{2}$ cwt.; 27/7/25, 28/5/26	3 14	1 19	1 15	2	8	6	1	6	6 $\frac{1}{2}$
Super, 1 $\frac{1}{2}$ cwt.; blood and bone, 1 $\frac{1}{2}$ cwt.; sulphate of potash, $\frac{1}{2}$ cwt.; 27/7/25, 28/5/26	4 8	2 3	2 5	2	16	6	1	5	11
Super, 3 cwt., 27/7/24, 28/5/26; nitrate of soda, 1 cwt., 7/10/25, 13/10/26	7 9	2 5	5 4	4	9	0	0	17	0 $\frac{1}{2}$

By weight the super and nitrate-of-soda plot has given the largest increase, due to the excellent rejuvenation of grasses of the rye-grass and cocksfoot type on this plot, indicating that if one were going to

top-dress this class of pasture it might pay to give an application of nitrate of soda the first year. The basic slag has given the cheapest increase, and the quality of the material on this plot is also very fine. The lime and super, super, basic super, and Nauru plots are all very good. The $1\frac{1}{2}$ cwt. super and $1\frac{1}{2}$ cwt. blood and bone, and the $1\frac{1}{2}$ cwt. super, $1\frac{1}{2}$ cwt. blood and bone, and $\frac{1}{4}$ cwt. sulphate of potash have given the most costly increase, due to the inclusion of the blood and bone and potash.

Strips were also top-dressed across this field with kainit, 2 cwt. per acre, applied on 27/7/25 and 28/5/26, and 30 per cent. potash, 1 cwt. per acre, 28/7/26, but neither have so far shown sufficient increase to warrant the application of these fertilizers.

It is not proposed to apply further dressings of phosphates to this field at present, but the lasting effects of the various phosphates will be observed for a year or two longer. The increased weight on most of the plots has been brought about chiefly by the increase in clovers, but the results from the super and nitrate-of-soda plot are so striking that it has been decided to top-dress cross-sections over all the plots with nitrate of soda and sulphate of ammonia in the current year and note results.

General.

The total area of the farm is 63 acres, of which last season 20 acres were in crop and 16 acres were cut for hay twice and 5 acres once. In addition the area carried on an average approximately $1\frac{1}{2}$ sheep per acre for the whole season, and could have done very much better had sheep been available when required. No sheep were on the farm in December, and very few in January and February.

COPPER-SULPHATE POISONING IN SHEEP: A WARNING.

SEVERAL instances have recently come under notice of mortality in hoggets and in grown sheep through drenching the animals with copper sulphate for stomach-worms. The drench in each case had been made at a strength of 2 to $2\frac{1}{2}$ per cent., instead of from 1 to $1\frac{1}{4}$ per cent., the correct strength. Also in each case mustard had been added. Mustard is probably used with the idea of stimulating the action of the bowel, but it must be remembered that when hoggets require a drench for parasites their stomach and intestines are already inflamed, and the action of mustard will still further inflame the surface of those organs.

The correct strength for copper sulphate for use in sheep is a 1 to $1\frac{1}{4}$ per cent solution—that is, $1\frac{1}{2}$ oz. to 2 oz. per gallon of water. Not more than the 2 oz. per gallon should be used, or the solution will be over strength. Dosage of the $1\frac{1}{4}$ -per-cent. solution should be employed as follows: Sheep, 3 oz.; hoggets, $1\frac{1}{2}$ oz. to 2 oz.; lambs, 1 oz.

For treffective eatment of worms the animals should be starved overnight, and not hurried out on to grass for several hours after dosage.

—*Live-stock Division.*

PARASITES OF THE PEAR-MIDGE (*Perrisia pyri*).

REPORT ON THE 1926 CONSIGNMENTS FROM EUROPE.

D. MILLER, Entomologist, Biological Laboratory, Wellington.

THE work of establishing pear-midge parasites in the midge-infested areas of New Zealand was continued during the 1926-27 season. Arrangements had been made with the Imperial Bureau of Entomology, London, for Dr. R. C. Fisher to secure consignments of parasitized midge larvæ from July to October, 1926.* This material, obtained in France and England, was carried during transport to New Zealand in ships' vegetable-chambers. In all there were five consignments, as follows :—

Table 1.

Consign- ment.	Place and Month collected.	Date received in New Zealand.
1	Chelmsford and Bedford; July	August 27th.
2	Versailles, Châtenay, and Angers; July	September 6th
3	Versailles, Châtenay, and Chelmsford; August	October 16th.
4	Versailles and Angers; September	October 30th.
5	Versailles and Châtenay; October	December 3rd.

The parasitized material was packed in damp moss placed in small wooden boxes, or in tins having the lids sealed with paper. The material as a whole arrived in good condition; but there was considerable variation in the moisture present in the different boxes, varying from dry to moist and very moist. In all cases where the very moist condition obtained the material was from the tins with paper-sealed lids

HANDLING IN NEW ZEALAND.

On arrival in New Zealand all the consignments, except the fifth, were placed in cool storage, from which the material was periodically removed as required. As shown in Table 1, the first two consignments arrived during August and early September, before the spring midges emerged in the field. In the first week of September leaves began to develop on the pear-trees, and on the 17th of that month the first midge was noted; by the 28th midges were common both in Auckland and Nelson, when the spring infestation had definitely commenced. With first sign of leaf-movement a batch of the first consignment of parasitized material was removed from cool storage and placed in emergence-boxes. Table 2 gives the history and average temperature of the several consignments under cool-storage conditions. To the periods of cool storage must be added in each case the period between leaving London and reaching New Zealand, which was practically the same with all consignments, though the actual average temperatures of the ships' vegetable-chambers are not known (approximately between 40° and 50° F.).

* An article by Dr. Fisher, giving an account of this work, was published in last month's *Journal*.

Table 2.

Consignment.	Batch.	Placed in Storage.	Removed from Storage.	Total Time in Storage (Days).	Average Daily Temperature.
1	First ..	27/8/26	7/9/26	11	41.0° F.
	Second ..	27/8/26	23/9/26	27	41.0°
2	First ..	6/9/26	23/9/26	17	43.0°
	Second ..	6/9/26	29/9/26	23	43.0°
	Third ..	6/9/26	19/10/26	43	44.85°
3	All ..	16/10/26	10/10/26	3	42.5°
4	All ..	30/10/26	20/11/26	21	44.0°
5	All ..	Not cool-stored	..	..	..

EMERGENCE OF PARASITES.

These 1926 consignments gave good results, a greater average number of parasites being secured than from the 1925 material Table 3 sets out the percentages of parasites (both *Platygaster* and others) secured from the material collected in the respective localities for the five 1926 consignments, and also the condition in which the material of each consignment arrived in New Zealand. It will be noted that the first three consignments have been classified according to locality and condition into two or more batches, and some of the latter into lots.

Table 3.

Consignment.	Batch and Lot	Locality	Platygaster.		Number of Capsids	Number of Chalcids	Condition.
			Per Cent of Total	Average Per Cent per Box.			
1	First ..	Chelmsford ..	6.45	0.54	6	2 ♀	Moist
	Second ..	Bedford ..	4.03	0.34	0	0	Moderately moist
2	First a ..	Versailles ..	1.61	0.54	0	2 ♀	Comparatively dry.
	First b ..	Versailles ..	0.68	2.42	0	2 ♀ 1 ♂	Very moist in tins.
	Second ..	Versailles ..	3.22	1.61	0	0	Moist
	Third a ..	Versailles, Châtenay, and Angers	0	0	0	0	Very dry.
	Third b ..	Versailles ..	6.15	3.22	0	0	Very moist in tins.
	Third c ..	Versailles ..	0	0	0	0	Very moist in tins, and midges in abundance.
3	First ..	Versailles and Châtenay	58.25	3.64	12	1 ♀ 1 ♂	Very moist.
	Second ..	Chelmsford ..	4.84	1.61	0	0	Very moist.
4	..	Versailles and Angers	6.45	0.32	0	0	Very moist.
5	..	Versailles and Châtenay	0	0	0	0	Very moist.

♂ = Male; ♀ = Female.

Since the number of boxes in each consignment varied, the average percentage of *Platygaster* emergence from the individual boxes in each consignment was taken as a basis to arrive at an idea as to what period of the year and what locality gave the best results. The data gained

by this method, though necessarily approximate, since the quantity of midge-infested material in each box would not be constant, agree very closely with Dr. Fisher's observations made on the controls kept at Oxford.

INFLUENCE OF MOISTURE ON PLATYGASTER EMERGENCE.

An important factor which would materially influence the emergence of *Platygaster* is moisture. As seen in Table 3, the very moist material in tins (consignment 2, first batch, lot *b*, and third batch, lot *b*) gave a much higher emergence than the others of the same consignment, while very dry material (consignment 2, third batch, lot *a*) gave no emergence at all. On the other hand, certain material (consignment 2, third batch, lot *c*), though very moist and in tins, gave no parasites of any sort, but an abundance of midges. In this last case apparently none of the midge larvæ was parasitized. In regard to consignment 5, it would appear that parasitism does not occur, or only to a very little extent, during October. Lack of moisture in this case could not have been the cause of no emergences, since the material was very moist and in good condition.

The best results, therefore, were secured from the moist to very moist material, the retention of sufficient moisture being an important factor, while the dry material gave few or no parasites or even midges. The best type of container for conserving moisture was the tin with paper-sealed lid. Wooden boxes allowed too great an evaporation unless completely wrapped in waxed paper (which has been found effective in the transport of blow-fly parasites).

INFLUENCE OF COOL STORAGE ON PLATYGASTER.

Concerning the influence of cool storage upon consignments 1 to 4, reference to Table 2 shows that the average daily cool-storage temperature at which the consignments were held varied from 41° F. to 44·85°, while the minimum period was 11 days and the maximum 43 days.

In the case of the first consignment the first batch, held for 11 days at 41°, gave a somewhat higher emergence (see Table 3) than the second batch, held for 27 days at the same temperature. The slight variation in emergence may have been due to other factors than cool storage, such as variation in moisture, or to the degree of parasitism in the two localities where material was collected (Chelmsford and Bedford).

The second consignment was divided into three batches, the first being held for 17 days at 43°, the second for 23 days at 43°, and the third for 43 days at 44·85°. In lots *a* and *b* of the first batch, both held for 17 days at 43°, the much lower emergence (0·54 per cent.) of lot *a* was no doubt due to the comparatively dry state of the material and not to temperature, since lot *b* (very moist and in tins) gave an emergence of 2·42 per cent. In the case of the second batch, held for 23 days at 43°, the emergence was 1·61 per cent., and here, where the moisture was favourable, this reduction might be ascribed to the longer period in cool storage, but a consideration of the third batch apparently contradicts this. The third batch was held for apparently a much longer period than the first and second (namely, 43 days), though at a slightly higher average temperature (44·85°). Nevertheless the

highest emergence percentage (3.22 per cent.) secured from the second consignment was from lot *b* of the third batch, the material of which was very moist. On the other hand, lot *a* of this batch contained very dry material and gave no emergences. It would appear, therefore, that lack of moisture, or state of parasitism, and not prolonged cool storage, was the factor influencing emergence, material in each lot having been collected at the same time from the same locality.

Owing to some of the material of the third consignment having been collected at Versailles and some at Chelmsford this consignment was divided into first and second batches respectively, and held in cool storage for three days at 42.5°. On this consignment being opened on removal from storage adult midges and parasites were found alive. Of all the consignments, the third gave the highest average emergence—5.25 per cent. The influence of cool storage, during both voyage and three days in New Zealand, apparently had had no serious influence on the ultimate results, this consignment being very moist and in a good condition. It will be noted (Table 3) that the percentage of emergence from the second batch (1.61) was much lower than that from the first (3.64), but this was perhaps due to the locality from which the material of the second batch had been collected.

The fourth consignment was held in cool storage for 21 days, at an average temperature of 44° and gave an emergence of 0.32 per cent. It is probable, however, that the main factor in this rapid drop in emergence was due to the lateness of the season (September) when the material was collected, the conditions of moisture in the packing being favourable.

The fifth consignment, collected in October, was not placed in cool storage and gave no emergences, though the moisture conditions were good. The lateness of the season was no doubt the main factor in this reduction, as in the case of the fourth consignment.

The very high emergence of the third consignment and the very low emergence of the fourth consignment might be ascribed to the influence of brief cool storage in the former and prolonged cool storage in the latter. On the other hand, in the second consignment lot *b* of the third batch gave a higher emergence, though held in cool storage for 43 days, than lot *b* of the first batch, held for 17 days, the conditions of moisture and locality being equal in both cases. Again the fifth consignment, not held in cool storage, gave no emergences. It would seem that cool storage, at least up to the point to which the first four consignments were subjected, did not seriously influence the percentage of *Platygaster* emergence.

PERIODIC EMERGENCE OF PLATYGASTER.

A consideration of the facts as set out in Table 3 shows that the percentage of emergence increased from the first consignment, through the second (both collected in July), to the third (collected in August), which latter gave the maximum number of *Platygaster*. In the case of the fourth consignment (collected in September) the number of *Platygaster* secured had dropped to below that of the first consignment, and from the fifth (collected in October) no parasites were secured, and very few midges.

It may be concluded from the foregoing that the best period (in England and France) for collecting material parasitized by *Platygaster* would be during July and August, and to a less extent in September. There is no doubt that the percentage of emergences secured from the July material would have been much higher but for some of the material being very dry when it reached New Zealand. It appears also that October is too late in the season for collecting material.

LOCALITY EMERGENCES OF PLATYGASTER.

Considering the *Platygaster* secured from the first three consignments (see Table 3): In the case of the first consignment—which was collected in England, at Chelmsford and Bedford—there was not much difference in the number of parasites secured from the two localities. The condition of the material from both localities was much the same, except that the Bedford material was slightly less moist than that from Chelmsford. The second consignment (collected during the same month as the first) was secured in France, and gave a higher average emergence, where the moisture conditions were favourable, than did the English material. A further interesting case for comparison is afforded by the third consignment, collected in August—some from France and some from England. Here, again, the moisture conditions being equal, the emergence from the English material was lower (about half) than that from France. From this it may be inferred that material collected in England during 1926 was less highly parasitized than that from France, the time of collecting and the moisture conditions being equal. Owing to variation of moisture conditions no definite conclusions can be drawn as to the localities in France from which the most highly parasitized material was secured, except in the case of Versailles and Châtenay.

PERCENTAGE OF SEXES OF PLATYGASTER.

A very noticeable feature was that a much greater number of female than male *Platygaster* emerged from all consignments: from records kept 33.33 per cent. of those secured were males and 66.67 per cent. females.

CHALCIDIDS AND CAPSIDS.

In all, twelve chalcidoids (ten females and two males) were secured from the first, second, and third consignments, both from the English and French material; while from the first and third consignments—English and French—eighteen capsids emerged.

Summary.

From July to October, 1926, five consignments of parasitized pear-midge material were collected in England and France. These, on the whole, arrived in New Zealand in good condition. After arrival all but the fifth were held in cool storage for varying periods.

It was found that the greatest number of *Platygaster* were secured from the French material, especially from Versailles and Châtenay, and that July and August were apparently the best months for securing parasitized midge larvæ.

It was also found that the presence of sufficient moisture was a fundamental factor influencing the parasites, and that dry material

gave very poor results. The best type of container was the tin with a paper-sealed lid, or wooden box wrapped in waxed paper. Cool storage, to the point to which the material was held in New Zealand, apparently did not influence the percentage of *Platygaster* emerging, the main influencing factors being locality, month of collecting the material, and moisture.

A much greater number of female than male *Platygaster* were secured—66.67 per cent. and 33.33 per cent. respectively.

A number of chalcidoids and capsids were secured from both the French and English material.

INTERMEDIATE HOST OF LIVER-FLUKE IN NEW ZEALAND.

RECORDED AS THE COMMON WATER SNAIL.

C. S. M. HOPKIRK, B.V.Sc., Officer in Charge, Wallaceville Veterinary Laboratory.

WITH regard to the presence of liver-fluke (*Fasciola hepatica*) in a portion of the North Island, an investigation has recently been carried out in the Hawke's Bay District for the purpose of determining what is the actual intermediate host of the fluke larva in this country.

Thomas, working in England, showed in 1883 that the sporocystic, redial, and cercarial stages of the fluke passed through a fresh-water snail, *Limnaeus truncatulus*, but this snail is not found in New Zealand. McKay, in New South Wales, proved *Limnaea brazieri* to be the intermediate host. In order to gain some idea of what species of water snails might be encountered in Hawke's Bay creeks, large amounts of watercress with snails adherent were examined. Unlike the experience of examination of similar material in Australia, species were few in number, but the representatives of species were frequently present in very large numbers. In the swifter-flowing creeks, and occasionally in the more open swamps, *Potamopyrgus antipodum* was the chief snail present. This variety is hard-shelled and difficult to crush between the fingers. A second snail was also found in the moving water, *Myxas arguta* (Hutton), formerly known as *Amphipeplea arguta*.

In the swamps where the water was fresh and where watercress was in evidence the softer-shelled snails lived in large numbers. Of these *P. antipodum* var. *zelandeae* was by far the most common. A few snails considered to be *P. corolla* var. *Salleana* were also noticed. A new species of *Planorbis* was found in a limestone swamp, and was named by Mr. H. J. Finlay, of Dunedin, to whom specimens were sent for identification, *Planorbis benhami*. Unfortunately, this particular swamp has since been completely drained, and further specimens have not been procurable.

By crushing snails out on glass slides it is possible to see the fluke larvæ moving about in the debris. The mother redia may be seen with the naked eye, but a low power of the microscope is required for cercarial forms. Four distinct species of cercariæ have been found

frequently: (1) A bifid-tailed variety, very fast moving and comparatively small; (2) an active variety bearing a spined tail; (3) an eyed form very similar to the cercariæ of *Fasciola*; (4) the cercariæ of *F. hepatica*.

All of these forms were found in the same species of snail, *P. antipodum* var. *zelandeae*, very possibly because of their thinner shell, which is so much more easily attacked, and because the swamp habitat of this snail is more conducive to parasitism. Snails received all the year round at this Laboratory from affected streams and swamps showed that the cercarial forms were present throughout the spring until December, but since then no larval stages have been found. Two reasons would appear to combine to cause this state—the facts (1) that warm weather appeared early in Hawke's Bay last year, and (2) that the season became very dry following a drought in the preceding year, when swamps had been thoroughly dried out. It would seem that the severe conditions obtaining in the preceding year had necessitated the killing-off of a greater proportion of sheep than usual in the district, and that sheep affected with fluke had died before the spring flush of grass in 1926. Snails were fewer, and with the early warm weather the cercariæ had encysted on the swamp-weeds correspondingly early. Sheep had not fed of necessity on the swamps until the autumn, and so had picked up the fluke in small numbers then. There was not the adult-fluke infestation of sheep to the same extent, and fewer eggs were passed than usual from the sheep. That, combined with a greatly lessened swamp area and number of snails to propagate the fluke, made it impossible to find the larval stage in the many thousands of snails examined.

Experimental work of hatching the eggs was easily carried out in a 22° C. incubator, the eggs hatching into fast-swimming miracidia in seventeen days, provided direct sunlight was brought to bear on the dishes on the seventeenth day. It was not possible, however, to induce these miracidia to become sporocysts, because it was found impossible to get the snails to live in the Laboratory in the aquaria set aside for them. Miracidia appeared to be attracted by the snail, but under the microscope were not seen actually boring into them.

As cercarial forms were not found when it was possible to carry out the work of feeding encysted forms to sheep and rabbits—that is, when the rush of routine work at the Laboratory was over after the New Year—this experimental portion of the investigation remains to be carried out during the coming season.

One factor which may have a bearing on the question—and McKay also mentions this fact in connection with his work in Australia—is the difference in the pH (*i.e.*, the reaction) of the water of the Hawke's Bay District in question and that of other parts of New Zealand. This Hawke's Bay water is 7.2 or thereabouts, while water at Wallaceville is at least as acid as 6.4; again, just outside the range of fluke-infestation of sheep the pH is 6.8. Neutral water has a pH of 7.0.

Though this fluke-investigation is by no means completed, yet the examination of many water snails has made it possible to record that the intermediate host of the liver-fluke (*F. hepatica*) in New Zealand is the common water snail *Potamopyrgus antipodum* var. *zelandeae*.

The life-cycle of the fluke may be set out as follows :—

Adult fluke present in sheep.

Egg present in faeces.

Miracidium present in swamp-water.

Sporocyst
Redia
Redia
Cercaria } present in snail.

Encysted cercaria present in water-weed eaten by sheep.

Larval fluke present in intestine of sheep.

Larval fluke present in peritoneal cavity of sheep.

Adult fluke present in bile-duct of sheep.

My thanks are due to Mr. H. J. Findlay for his identification of species of water snails.

ASHBURTON EXPERIMENTAL FARM.

OPERATIONS IN 1926-27.

J. W. HADFIELD, Instructor in Agriculture, Christchurch.

OPERATIONS at the Ashburton Experimental Farm during the agricultural year 1926-27 were conducted as usual under the working management of Mr. J. G. McKay. The practice in the past, with a few exceptions, has been to publish in one report the results of all experimental work carried out on the farm. The large amount of data becoming available under present methods, however, would render the report too long for publication in any one month. Moreover, there is a decided risk of much of the specific work losing its identity and being disregarded if incorporated with a mass of other material. It has therefore been arranged to publish as separate articles the results of the main experiments examined by the statistical method. These will be contributed to the *Journal* by Mr. A. W. Hudson, who is specializing in this branch of the work in Canterbury. The principal subjects (continuing in most cases the records of the 1925-26 year's work, published in the *Journal* for November last) comprise the following :—

- (1) Wheat variety trial, with College Hunter's as control.
- (2) Manurial experiment with wheat—Ammono-Phos *versus* superphosphate and sulphate of ammonia.
- (3) Manurial experiment with oats, comparing the effect of superphosphate against a proprietary grain-manure in quantities of 1 cwt. and 2 cwt. per acre.
- (4) Top-dressing of lucerne; further increases resulting in 1926-27 from the application of lime and superphosphate in 1924.
- (5) Treatment of seed wheat; the effect of Semesan, copper carbonate, and formalin upon germination and yield. The results of this trial have been so strikingly in favour of Semesan and copper

carbonate, both in germination and subsequent yield, that to publish the results of this one year's trial might be very misleading. A second year's test appears desirable before any results are published, and further trial sowings were made last autumn. These included bluestone in addition to the other treatments specified. It may be noted here that the various treatments so materially affect germination that the varying yields may be due as much to thick and thin seeding as to any direct action of the treatment. The trial this current year has been designed to examine the effect of thick and thin seeding as distinct from that of the treatment.

Green manurial experiment with oats; determination of the effect of ploughing in various crops upon the yield of oats. Owing to the variable nature of the soil on the farm this experiment will be discontinued, and the results obtained during the past season will not be published.

Following are notes on more general work carried out on the farm during the past year:—

PURE LINES OF SEED.

A pure line of Dreadnought wheat, selected by Mr. McKay during 1924, yielded sufficient grain to enable it to be passed for multiplication to Mr. J. Ruddenklau, of Glenavy, South Canterbury. A limited supply of seed should be available for distribution by Mr. Ruddenklau after the season 1927-28. In the meantime further selection is in progress to enable pure seed to be distributed every few years.

Mr. McKay is also engaged in raising pure seed of Major, Marquis, Red Fife, Yeoman, Trifolium 14, and Essex Conqueror wheats, with a view to having such seed available for co-operative field trials during the next few years.

The Ferristen mangold, a variety of Danish origin selected over a series of years at the late Moa Seed-farm, Central Otago, has proved of sufficient promise to warrant further trials. Seed is not available, but from a number of roots grown during the past year it is hoped next season to harvest sufficient to enable a comprehensive trial to be carried out.

POTATOES.

In view of the initiation of seed-potato certification this season a large number of varieties were grown on the farm, the seed having been collected from various sources in Otago, Southland, and Canterbury. The object was to collect data in regard to the characteristics of our commercial varieties and to determine the general standard as to purity and disease. Twenty varieties were under test, and of sixty-two lines submitted seven were wrongly named and the remainder contained 7.8 per cent. of rogues. Counts were also made of plants in each line obviously below the general standard, and these revealed the presence of 26.7 per cent. of subnormal plants, due in most cases to the presence of disease. Opportunity was taken to make a large number of single plant and tuber unit selections from the healthiest lines submitted. It is hoped to make use of these in the production of pure disease-free lines.

LUCERNE.

Satisfactory evidence is again forthcoming as to the value of lucerne for hay and grazing purposes in the district. In the report for the 1925-26 season it was stated that, "although certain areas have been grazed on almost every occasion since they were sown in March, 1921, there is very little evidence of deterioration due to grazing; nevertheless such evidence is directly proportionate to the extent of grazing carried out." It now becomes necessary to add that the past season (1926-27) is the first in which any marked deterioration has been evident as a result of grazing the stands on this farm. An area grazed throughout the 1925-26 season for the first time was fully 8 in. shorter in growth in October than the adjoining area that had been hayed. The season was dry, growth was very scanty after the New Year, and the yields of hay were lower than in any previous year.

The following grazing records, supplied by Mr. McKay, afford ample evidence of the value of lucerne:—

Area of 9 acres:—

146 hoggets and wethers	..	..	Sept. 14 - Oct. 18 = 34 days.
150 hoggets and wethers	..	..	Oct. 30 - Nov. 17 = 18 days
74 ewes and 74 lambs	..	..	Nov. 8 - Nov. 17 = 10 days
66 ewes and 74 lambs	..	..	Dec. 6 - Dec. 28 = 22 days

Area of 11 acres:—

Hayed, yielding a little over 1 ton of hay per acre. Grazed 290 dry ewes, Nov. 29 to Dec. 8 = 10 days.

Combined area (20 acres):—

66 ewes and 73 lambs	..	..	Dec. 29 - Jan. 31 = 34 days
89 wethers and 47 lambs	..	..	Feb. 20 - Feb. 24 = 5 days.

Area of 13 acres:—

430 hoggets	..	..	..	Sept. 16 - Oct. 5 = 19 days.
150 ewes	..	..	..	Nov. 5 - Nov. 19 = 14 days.
140 ewes	..	..	..	Nov. 9 - Nov. 29 = 20 days.
147 hoggets	..	..	..	Dec. 13 - Jan. 7 = 25 days.
66 ewes and 47 lambs	..	..	..	Feb. 5 - Feb. 9 = 4 days
89 wethers and 47 lambs	..	..	..	Feb. 10 - Feb. 19 = 9 days.

An area of 2 acres that had been planted in wide rows was cultivated in March, 1926, and sown down with 1 acre each of Garton and Algerian oats at 2 bushels per acre. These were harvested with the main lucerne crop in November. The Algerians were then in ear, though not quite at the milk stage, and the Garton's were still in the shot blade.

The oats had a decidedly depressing effect upon the growth of the lucerne. They also bulked largely in the mixture, and, as they required more weathering, difficulty was experienced in saving the combination of lucerne and oats in good condition.

PLANT-DISEASE CONTROL.

Mr. J. C. Neill, Field Mycologist, has again made full use of the farm in conducting research work upon disease-control. One area was devoted to the control of corticium in potatoes, the seed being subjected to various treatments before planting. A second area was used for comprehensive trials in connection with the control of cereal diseases.

WHITE ISLAND MINERAL DEPOSIT.

TRIAL AS TOP-DRESSING FERTILIZER FOR PASTURE.

T. H. PATTERSON, H.D.A., Instructor in Agriculture, and J. W. WOODCOCK, N.D.A., Assistant Instructor in Agriculture, Auckland.

THE attention of farmers and others interested in agriculture has been drawn during recent years to products from White Island, the active volcanic island in the Bay of Plenty. A proprietary company is working various deposits, which are on the market as fertilizers. There is a guano of comparatively low-grade quality, and also a mineral deposit consisting mainly of sulphur, gypsum, and silica. While the value of bird-guano is well known as a fertilizer, the value of White Island mineral deposit, which forms the base of several mixtures now offered, is not so well known. The product being a local one, and many inquiries having been received of late by the Department of Agriculture as to its efficacy as a fertilizer, experiments were commenced last year to test it. The trials were made on grass pasture, and the ground mineral deposit was tried as a top-dressing side by side with superphosphate. The chemical analysis of the sample submitted was as follows :—

			On Sample as received. Per Cent.	On Water-free Sample. Per Cent.
Water	..	..	20.8	..
Free sulphur	..	..	20.9	26.4
Calcium sulphate (gypsum)	..	..	8.9	9.9
Silica	..	..	42.5	53.7
Nitrogen	..	..	0.02	0.02
Phosphoric acid	..	..	Trace	Trace
Potash	..	..	Trace	Trace

As there is no appreciable quantity of either phosphate, nitrogen, or potash contained in this substance, it could not be registered as a fertilizer under the Fertilizers Act. By reason of its sulphur and gypsum content, however, it may possess fertilizing-qualities.

Attention has often been directed to sulphur as an element of importance in plant-nutrition, and it has been claimed that the sulphur content of superphosphate is partly responsible for the undisputed success of this fertilizer. But this has never been definitely proved ; in fact, applications of pure sulphur to crops in New Zealand have never met with any noticeable success. Gypsum has long been regarded as a soil-improver. Some authorities have stated that, in addition to its other benefits in relation to the soil, it releases potash and makes it available as a plant-food. Its beneficial effect on the physical condition of the soil, in common with burnt lime, was recognized many years ago, when the practice of applying "land plaster," as it was then called, was quite common. The mineral mixture of gypsum and sulphur, &c., it was suggested, might prove of use to crops in one or more ways. It might be a direct plant-food, or it might act as an agent which could release and make plant-food available ; or it might be used in conjunction with phosphatic fertilizer, such as rock phosphate, to render the phosphate more

readily available. The Department therefore decided to test this White Island product.

An experiment was laid down in 1926 on the property of Mr. R. Burke, Waihou. The material was used as a pasture top-dressing, and its effects were compared, as stated, with those of superphosphate, while portions of the field were left unmanured. The field had been down in grass for fourteen years, and previous to treatment had been top-dressed for five years—the first year with a mixture of 1 cwt. blood and bone and 2 cwt. super per acre, and the subsequent four years with 2 cwt. to 3 cwt. super annually. It had been cut for hay for five successive years. The soil is a light loam, overlying pumice rubble, typical of much of the Thames Valley and Waikato. The adverse effects of repeated cutting for hay and of hard grazing were demonstrated by the turf carried, which was chiefly composed of cocksfoot, yellow suckling-clover (trefoil), rib-grass, hair-grass, and Yorkshire fog, although a few of the better grasses, &c., including perennial rye-grass, crested dogtail, and white clover, were present. Under such conditions, therefore, the fertilizers had every chance of asserting themselves in improving the pasture.

The manures were applied on 14th July, and the application of both White Island product and super was at the rate of 3 cwt. per acre, although, owing to the damp nature of the former and the varying rate at which it ran through the drill, the quantity actually sown was slightly under the intended amount. Thirteen plots, each $\frac{1}{2}$ chain wide by 8 chains in length, were alternated, giving four plots of each manure and five check plots. The field was closed for hay during early October, and cut on 8th January last. Two cuts of the mower were taken along each plot, and each swath was measured up into chain lengths and the green material on each weighed. The swath nearest to the adjoining plot was taken in each case for making comparisons by "Student's" method, the results being presented in the following table :-

Treatments. A compared with B				Number of Paired Plots.	Yield of Green Material per Acre	Difference in Favour of A.	* Difference Significant (S) or Non-significant (N S)
A. Super ..	..	..	} 21 {		Tons. 6.17	Tons. 0.144	S.
B. No manure ..	..	..			5.73	..	..
A. No manure ..	..	..	} 28 {		5.72	0.437	S.
B. White Island product ..	..	..			5.29	..	..
A. Super ..	..	..	} 21 {		5.51	0.100	S.
B. White Island product ..	..	..			5.11	..	..

* A difference is regarded as "significant" when the chances are greater than 30 to 1 in its favour.

Cost of manures: Super, £5 12s. 6d. per ton f.o.r.; White Island product, £6 10s. per ton f.o.r.

It will be seen that superphosphate gave weight-increases over both check (no manure) and White Island product; while the latter, when directly compared with no manure, caused a depression in yield. The trials will be carried a further stage during the season of 1927-28.

WHEAT-MANURING EXPERIMENTS IN CANTERBURY, SEASON 1926-27.

A. W. HUDSON, B.Sc., B.Ag., Instructor in Agriculture, Christchurch.

CO-OPERATIVE experiments on the manuring of wheat were again carried out in the past season on four farms in the Springs and Ellesmere districts. The methods employed for the sowing, harvesting, and threshing of the crops followed the uniform practice adopted by the Fields Division in Canterbury, which was described in a special article published in the *Journal* for July, 1926.

Experiment 1: Farm of J. Foster, Ladbroke's.

Sowing in this experiment took place on 26th June, 1926, and the plots were harvested on 3rd February, 1927. The wheat variety was College Hunter's, sown at the rate of $1\frac{1}{2}$ bushels per acre. The previous history of the field was: 1925-26, potatoes; 1923-25, grass; 1922-23, wheat. The soil was defined by analysis as a silty loam.

The manurial treatments, at per-acre rate, were as follows:—

- | | | | |
|--|----|----|---------------------|
| (1) Control (no manure). | | | |
| (2) Super, 42/44 per cent. tricalcic phosphate | .. | .. | 1 cwt. |
| (3) Super, 42/44 per cent. tricalcic phosphate | .. | .. | 2 cwt. |
| (4) Basic super, 41/43 per cent. tricalcic phosphate | .. | .. | 1 cwt. |
| (5) Basic super, 41/43 per cent. tricalcic phosphate | .. | .. | 2 cwt. |
| (6) Super, 1 cwt., plus dried blood (approx. 13 per cent. nitrogen), | | | |
| 1 cwt. | .. | .. | 2 cwt. |
| (7) No. 6 mixture, plus sulphate of potash (48 per cent. K_2O), | | | |
| $\frac{1}{2}$ cwt. | .. | .. | $2\frac{1}{2}$ cwt. |

Seven replications of the above were sown, and the plots divided into four subplots at harvest. Up to twenty-eight plots were therefore available for comparison. Accidents during threshing, &c., were responsible for loss of correct weights of some plots; hence the number of paired plots in the table varies with different treatments.

Observations during Growth.

24th August, 1926: All manured plots equal in appearance and slightly better than control.

15th November: The crop had an exceptionally good deep-green colour. The controls were about 6 in. shorter than the average of the manured plots (see Fig. 1). The super, 2 cwt., and basic super, 2 cwt., per-acre plots were taller than the other manured plots.

11th January, 1927: Rust was very much in evidence. Apart from a slightly greener tinge, the controls were not distinguishable from the manured plots.

The yield results of this experiment are shown in Table I. (NOTE.—The small differences in yield between the same treatments where recorded in more than one place are due to the different numbers from which the respective means have been calculated. This applies to all the tables.)



FIG. 1. WHEAT-MANURING EXPERIMENTAL PLOTS ON J. FOSTER'S FARM, LADBROOK'S.

Mr. J. W. Hadfield standing with one leg in a control plot (showing shorter growth) and the other in a super, blood, and potash plot. A 1-cwt. basic super plot lies on right of control.

[Photo by the Writer.

Table 1.—Results of Experiment 1.

[Seven replications of each treatment. Plots divided into four subplots at harvest
Area of individual subplot, $\frac{1}{103.7}$ acre.]

Treatments. A compared with B				Number of Paired Plots.	Bushels per Acre.		*Difference Significant (S.) or Non-significant (N.S.).
					Yield.	Difference.	
A. Control (no manure)	..	..	..	27	41.9	..	..
B. Super, 42/44, 1 cwt	..	..	..		46.9	5.0†	S.
A. Control ..	..	..	..	26	41.8	..	..
B. Basic super, 1 cwt.	..	..	..		46.8	5.0	S.
A. Super, 1 cwt.	..	..	..	25	47.6	0.3	N.S.
B. Super, 2 cwt.	..	..	..		47.3	..	..
A. Basic super, 1 cwt.	..	..	..	25	47.1	0.7	N.S.
B. Basic super, 2 cwt.	..	..	..		46.4	..	..
A. Super, 1 cwt.	..	..	..	24	47.8	0.9	N.S.
B. Super, 1 cwt.; dried blood, 1 cwt.	..	..	..		46.9	..	..
A. Super, 1 cwt.; dried blood, 1 cwt.	..	..	..	24	46.4	..	..
B. Super, 1 cwt.; dried blood, 1 cwt.; sulphate of potash, $\frac{1}{2}$ cwt.	..	..	..		47.9	1.5	S.

* A difference is regarded as "significant" when the chances are greater than 30 to 1 in its favour.

† The difference in each case is shown opposite the higher-yielding plot.

Comments.

(1) Super, 1 cwt., and basic super, 1 cwt., show equal increases over the control. Five bushels at 5s. per bushel (approximate net value after allowing for threshing, hauling, railage, &c.) must be regarded as a highly profitable increase, the manure costing only about 6s. per cwt.

(2) Neither form of phosphate at 2 cwt. per acre has shown any increase over the same phosphate at 1 cwt. Hence the growth noted on 15th November did not indicate the result.

(3) The addition of 1 cwt. dried blood to 1 cwt. super has not caused an increase over the straight-out 1 cwt. super. This is not surprising, as none of the plots showed any indication of lack of nitrogen so far as can be measured by growth and colour of the crop.

(4) Sulphate of potash ($\frac{1}{2}$ cwt.) added to super and blood has been responsible for a definite increase of $1\frac{1}{2}$ bushels per acre over the super and blood. This increase, however, is not a paying one; cost of the potash is 9s. for $\frac{1}{2}$ cwt., and value of increase due to it 7s. 6d.

(5) A direct comparison between 2 cwt. quantities of super and basic super shows no significant difference.

(6) Like many of the wheat crops grown on the better-class land in the past season, the one under review suffered severely from rust-attack, and did not yield up to expectations.

Experiment 2 : Farm of Messrs. W. and A. Campion, Prebbleton.

Date sown, 12th June, 1926; date harvested, 1st February, 1927; variety, Solid-straw Tuscan; seeding, $2\frac{1}{4}$ bushels per acre. Previous history of field—1925–26, Italian rye-grass; 1925, crop of rape ploughed in; 1923–24, wheat, and fallowed from time wheat crop taken off till rape was sown. The soil is a medium loam, somewhat lighter than that of Foster's farm.

The manurial treatments used were the same as for Experiment 1. Eight replications were put down, each plot being divided into three subplots at harvest-time.

Observations during Growth.

On 24th August the controls were very backward (see Fig. 2). Throughout the growing-period the manured plots showed a marked superiority of growth over the controls, although the latter were of a decidedly better colour. Of the manured plots super and blood, super and blood and potash, and super, 2 cwt., were the best grown. The whole of the manured plots appeared to have outgrown the nitrogen-supply, and exhibited signs of nitrogen starvation. This was most marked on the heavily phosphated plots, and least evident on the plots having blood.

The yield results are shown in Table 2.

Comments.

(1) The increases over control of 2.7 and 3.4 bushels per acre from super, 1 cwt., and basic super, 1 cwt., respectively are quite profitable.

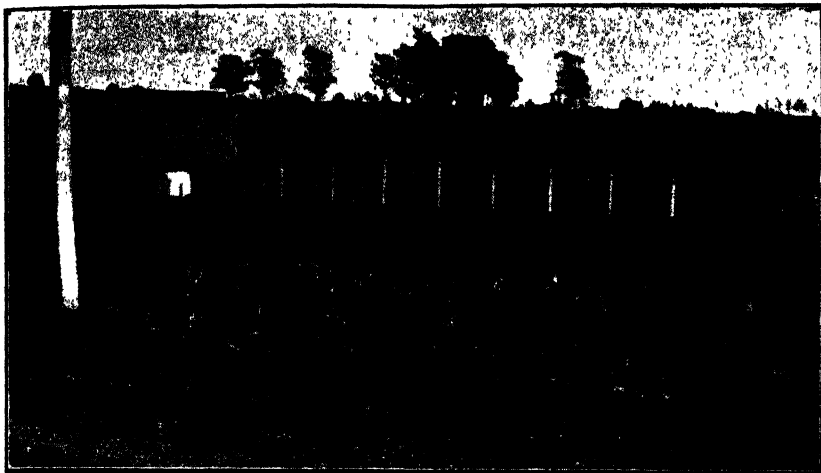


FIG. 2. VIEW OF PLOTS ON FARM OF W. AND A. CAMPION.

Where possible, experiments are laid down alongside a road, and a notice drawing attention to the experiment is erected. A box below the notice contains typewritten descriptions of the experiments, which in conjunction with the pegs enable interested farmers to watch the effect of the different manures.

[Photo by E. M. Bates.]

Table 2.—Results of Experiment 2.

[Eight replications of each treatment. Plots divided into three subplots at harvest.
Area of individual subplot, $\frac{1}{95.25}$ acre.]

Treatments: A compared with B.	Number of Paired Plots.	Bushels per Acre.		Difference Significant (S.) or Non-significant (N.S.).
		Yield	Difference	
A. Control (no manure)	24	25.9	..	S.
B. Super, 42/44, 1 cwt.		28.6	2.7	
A. Control	24	25.9	..	S.
B. Basic super, 1 cwt		29.3	3.4	
A. Super, 1 cwt.	23	28.8	..	N.S.
B. Super, 2 cwt.		30.1	1.3	
A. Basic super, 1 cwt	23	29.4	0.2	N.S.
B. Basic super, 2 cwt.		29.2	.	
A. Super, 1 cwt.	24	28.6	..	S.
B. Super, 1 cwt. ; dried blood, 1 cwt.		32.1	3.5	
A. Super, 1 cwt. ; dried blood, 1 cwt.	24	32.1	..	N.S.
B. Super, 1 cwt. ; dried blood, 1 cwt. ; sulphate of potash, $\frac{1}{2}$ cwt.		32.6	0.5	

A direct comparison between the yields from these two manures shows no significant difference.

(2) Super 2 cwt. does not give a significant increase over 1 cwt. of the same manure. The chances in this case approach significance. In any case, the increase of 1.3 bushels is worth only 6s. 6d., so that even if the difference is real it does little more than pay for 1 cwt. of super.

(3) The 1-cwt. and 2-cwt. basic super plots do not differ appreciably.

(4) A direct comparison of 2 cwt. super with 2 cwt. basic super shows that the plots of these two manures do not differ significantly in the yield.

(5) Blood added to super has registered an increase over the straight phosphate of 3.5 bushels per acre. Value of increase at 5s. per bushel equals 17s. 6d.; cost of 1 cwt. dried blood, 13s.; profit, 4s. 6d. per acre over that obtained from super. It is highly probable that an equivalent amount of nitrogen in the form of nitrate of soda or sulphate of ammonia would have been of considerably greater benefit.

(6) $\frac{1}{2}$ cwt. of sulphate of potash added to the super and blood has been of no benefit.

Experiment 3 : Farm of F. W. Carpenter, Ladbroke's.

Date sown, 26th May, 1926 ; date harvested, 25th January, 1927 ; variety, Solid-straw Tuscan ; seeding, $1\frac{1}{4}$ bushels per acre. Previous history of field—1925-26, rape ; 1924-25, Italian rye-grass ; 1923-24, rape. The soil is similar to that on Champions' farm.

The manurial treatments given per acre were as follows :—

Control (no manure).

Super, 42/44 per cent. tricalcic phosphate, 1 cwt.

Super, 42/44 per cent. tricalcic phosphate, 2 cwt.

Super, 1 cwt., and nitrate of soda, 36 lb.

Super, 1 cwt., and nitrate of soda, 87 lb.

Super, 2 cwt., and nitrate of soda, 87 lb.

The nitrate of soda (containing between 15 and 16 per cent. nitrogen) was applied on 8th September. It had been intended to apply the nitrate of soda at 1 cwt. and $\frac{1}{2}$ cwt. per acre instead of at the rates shown—87 lb. and 36 lb. The physical conditions of nitrate of soda make its uniform application somewhat difficult, however, and the result in this case was that less than the desired amount went on. Ten replications were sown, each plot being divided into three subplots at harvest.

Observations during Growth

26th August : The manured plots, as seen in Fig. 3, were very superior in growth to the controls, but equal to one another.

27th September : About three weeks after application of nitrate of soda there was no apparent effect from this manure, although at this time the 2-cwt. super plots were decidedly better than those receiving 1 cwt. The whole crop looked quite healthy, and in this case did not exhibit nitrogen starvation to any extent. Ten days later the effect of the nitrogen was much in evidence ; the plots receiving nitrate of soda displayed an increased growth, and had taken on a very deep-green colour.

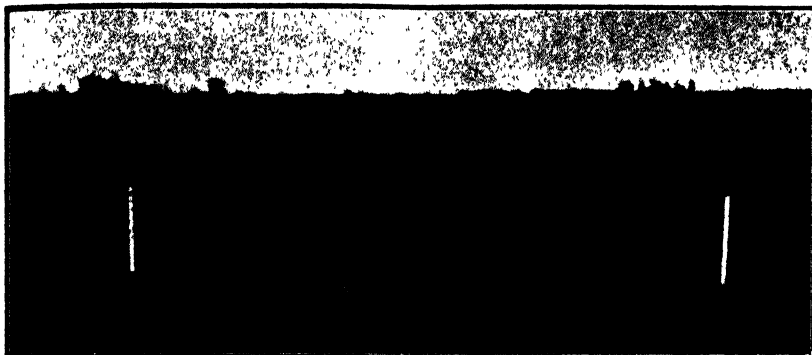


FIG. 3. PLOTS ON F. W. CARPENTER'S FARM

At this stage the plots afforded a striking example of the effect of super-phosphate on early growth. The backward plots are the controls.

[Photo by E. M. Bates.]

From early October to the time of ripening the superiority of the nitrogen-treated plots was very marked. The plots having phosphate alone never looked as healthy as the control or nitrate plots, although their growth was greater than that of the controls.

The yield results are shown in the next table.

Table 3.—Results of Experiment 3.

Ten replications of treatments. Plots divided into three subplots at harvest.

Area of individual subplot, $\frac{1}{84.9}$ acre. Number of paired plots, 30.]

Treatment.	Bushels per Acre.		Net Profit per Acre.†		
	Yield	Increase over Control *			
			£	s	d.
Control	27.9	..	..	..	..
Super, 1 cwt.	30.6	2.7	0	7	6
Super, 2 cwt.	30.7	2.8	0	2	0
Super, 1 cwt., and nitrate of soda, 36 lb ..	33.8	5.9	0	18	6
Super, 1 cwt., and nitrate of soda, 87 lb. ..	35.8	7.9	1	1	0
Super, 2 cwt., and nitrate of soda, 87 lb. ..	36.9	9.0	1	0	6

* The increases over control only are shown in this table. Comparisons indicated in the accompanying comments have been examined statistically.

† Net profit is calculated on the following prices: Super, 6s. per cwt., nitrate of soda, 16s. per cwt.; wheat, 5s. per bushel. The amount shown represents the difference between the value of the increase and the cost of the manure.

Comments.

(1) The figures in the column headed "Net Profit per Acre" (Table 3) show quite clearly the position of the treatments.

(2) Failure of the 2 cwt. super, which promised well during growth, to give an increase over the 1 cwt. has reduced the net profit to a very small amount. Hence 1 cwt. has been a better-paying application

(3) Of the plots treated with nitrate of soda, the 1-cwt. super plot receiving 87 lb. nitrate of soda shows the best returns.

(4) It is interesting to note that even the small application of 36 lb. nitrate of soda to 1-cwt. super plots has given an increase over 1 cwt. of super amounting to 3.2 bushels per acre.

(5) A direct comparison of super, 1 cwt., plus nitrate of soda, 87 lb., and super, 2 cwt., plus nitrate of soda, 87 lb., shows a significant increase in favour of the latter to the extent of 1.1 bushels per acre. In view of the fact that 2 cwt. super failed to increase the yield over that of 1 cwt., the result indicates that full use could not be made of the heavier dressing of phosphate so long as some other factor (in this case nitrogen deficiency) was operating.

(6) The increases resulting from the application of nitrate of soda are very similar to those obtained in the preceding year on the same farm, when 93 lb. nitrate of soda top-dressed on a 1-cwt.-per-acre super plot caused an increase of 5.9 bushels per acre over the straight-out 1 cwt. super (see *Journal* for August, 1926, page 112). This point is important, as the winter of 1925 was one of the wettest on record, and must have caused excessive leaching of nitrates, while that of 1926 was an equally dry one, although the late spring brought plentiful rain.

(To be continued.)

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1926-27.

Dairy Division.

LISTS of butter and cheese factories that have obtained for their export produce an average grade of 93 points or over for the past dairy year—1st August, 1926, to 31st July, 1927—are here presented. Last year's lists included all factories with an average grade of 92 points and over, but it has now been decided to limit publication to averages of 93 points and upwards. It is very satisfactory to note the improvement in quality of both butter and cheese during the past year. The number of factories averaging 93 points and over shows an increase of thirty-one in butter and forty-eight in cheese manufacture as compared with the 1926 lists.

BUTTER-FACTORIES.

Name of Company.	Registered No.	Brand.	Average Grade.
Rangitikei	1360	Rangitikei	95.030
Wairoa	1345	Wairoa	94.944
Heretaunga	1230	Heretaunga	94.775
Awahuri	664	Red Rose	94.738
Taieri and Peninsula (Dunedin) ..	54	Taieri and Peninsula	94.620
Levin	910	Lake	94.606
Mangorei	345	Mangorei	94.553
Waitaki	812	Waitaki	94.500

BUTTER-FACTORIES—continued.

Name of Company.	Registered No.	Brand.	Average Grade.
Cheltenham	3	Pakeha	94.352
Waitara	726	Waitara	94.332
Wangaehu	1326	Wangaehu	94.289
Midhurst	110	Rugby	94.272
Lepperton	49	Lepperton	94.270
Uruti	300	Uruti	94.235
Moa Farmers'	341	Inglewood	94.188
Bell Block	488	Bell Block	94.166
Rata	938	Rata	94.073
Waipukurau	1455	Mount Vernon	94.072
Kia Ora	926	Kia Ora	94.059
Tolaga Bay	1007	Tolaga Bay	94.036
Masterton	1307	Masterton	94.010
Tarata	631	Tarata	93.986
Tarururangi	728	Champion	93.975
Stratford	68	Stratford	93.949
Taihape	1188	Tikapu	93.837
Maketawa	342	M.D.C.	93.829
Shannon	1489	Shannon	93.824
Tariki	1813	Tariki	93.799
Tikorangi	102	Shield	93.725
North Taranaki	723	Flax	93.712
New Zealand (Ngatea)	291	Anchor, &c	93.702
Mauriceville	14	Mauriceville	93.675
Farmers' Dairy Federation	336	Murihiku	93.625
Palm	1838	Palmerston	93.582
Taieri and Peninsula (Oamaru)	1234	Taieri and Peninsula	93.540
Norsewood	600	Norsewood	93.528
New Zealand (Frankton Junction)	1510	Anchor, &c	93.527
Omata	82	Omata	93.513
Piopio	603	Piopio	93.462
Co-operative of Otago	266	Huia	93.460
Kairanga	1768	Longburn	93.421
Kaikoura	302	Kai	93.370
Ngatiporou	395	Nati	93.323
Kiwi	299	Kiwi	93.314
Raetihi	717	Raetihi	93.306
Rongotea	8	Rongotea	93.303
New Zealand (Wairuku)	111	Anchor, &c	93.253
Owaka	328	Owaka	93.250
New Zealand (Waharoa)	293	Anchor, &c	93.239
Ormondville	735	Ormondville	93.217
Kaitieke	1119	Kaitieke	93.210
Konini	1203	Konini	93.206
Eltham	31	Eltham	93.179
Golden Bay	146	Golden Bay	93.161
West Coast Farmers'	675	Silver Pine	93.150
Te Aroha	344	Overseas, &c	93.128
Waikato Valley	397	Waikato Valley	93.093
Golden Coast	991	Golden Coast, &c.	93.070
Opotiki	337	Opotiki	93.039
Lowgarth	629	Lowgarth	93.033
Waimate	244	Waimate	93.030
Rangiwahia	750	Quail	93.025
Tai Tapu	175	Tai Tapu	93.025
Okioia	413	Okioia	93.020
Manutahi	495	Manutahi	93.019
Ruawai	66	Ruawai	93.017

CHEESE-FACTORIES.

Name of Company.	Registered No.	Brand.	Average Grade.
Milton	1030	Milton	94·130
Omimi	74	Omimi	94·060
Waiohiki	1681	Waiohiki	93·924
Bell Block	488	Bell Block	93·924
Edendale	36	Pioneer	93·776
Bidwell	270	Bidwell	93·748
Kaiparoro	619	Bruce	93·723
Cardiff	10	C.C.C.	93·717
Staveley	1719	Staveley	93·690
Kairanga	184	Fitzherbert	93·689
Takamatua	33	Takamatua	93·684
Tamaki	1463	Tamaki	93·622
Lowgarth	629	Lowgarth	93·597
Dalefield	9	Dalefield	93·577
Pembroke	234	Pembroke	93·563
Pihama	627	Pihama	93·555
Kairanga	182	Kairanga	93·547
Ngære	25	Triumph	93·509
Westmere	1621	Westmere	93·506
Hopelands	1178	Hopelands	93·495
Temuka	207	Ohape	93·438
Ryal Bush	477	Ryal Bush	93·437
Brown's	925	Brown's	93·433
Tuturau	132	Tuturau	93·427
Seaward Downs	702	Seaward Downs	93·423
Tamaki	58	Tamaki	93·406
Collingwood	1742	Collingwood	93·400
Mosgiel	161	Mosgiel	93·400
Kahui	493	Kahui	93·397
Boggy Burn	703	Boggy Burn	93·380
Kaponga	1696	Rowan	93·368
Milford	267	Milford	93·365
Little Akaloa	32	Little Akaloa	93·360
Ashburton	81	Ashburton	93·360
Kaupokonui	1733	Kaupokonui	93·352
Uruti	300	Uruti	93·351
Collingwood	1254	Collingwood	93·345
Alton	1890	Alton	93·301
Fairfax	1004	Fairfax	93·299
Kairanga	1768	Longburn	93·281
Mangatoki	136	Mangatoki	93·244
Kaupokonui	633	Kaupokonui	93·243
Waitoitoi	20	Waitoitoi	93·242
Silverstream	264	Silverstream	93·240
Mangatoki	1086	Mangatoki	93·231
Paretai	271	Paretai	93·230
Oware	662	Oware	93·175
Carrington	621	Carrington	93·163
Woodville	1892	Woodville	93·158
Woodlands	1485	Woodlands	93·145
Awarua	545	Awarua	93·144
Momona	1010	Momona	93·140
Waimana	1817	Waimana	93·138
Nireaha	335	Nireaha	93·135
Kaimata	992	The Oaks, &c.	93·131
Wyndham	59	Wyndham	93·128
Kuku	905	Ohau	93·118
Waiotahi	1159	Waiotahi	93·117
Kakaramaea	630	Kakaramaea	93·103
Stirling	292	Stirling	93·080

CHEESE-FACTORIES—*continued.*

Name of Company.	Registered No.	Brand.	Average Grade.
Waikouaiti	18	Waikouaiti	93·080
Wellington Dairy-farmers'	252	Onward	93·079
Belvedere	486	Belvedere	93·076
Barry's Bay	401	Barry's Bay	93·070
Taratahi	101	Taratahi	93·044
Bell Block	71	Dove	93·024
North Tiraumea	1559	North Tiraumea	93·018
T. L. Joll	1723	Joll's	93·000

THE FIREBLIGHT REGULATIONS AND HAWTHORN.

SHORTLY after the outbreak of fireblight in New Zealand it became evident that the hawthorn was an important host plant for the disease; further, that owing to the fact of it being planted in hedge form it was playing and would continue to play a most important part in the spread of the disease. Experience soon demonstrated that fruitgrowing on a commercial basis could not be carried on satisfactorily side by side with such hawthorn hedges once fireblight had made its appearance.

In order to meet the position, and to give fruitgrowers an opportunity of combating the disease with some chance of success, and at the same time take into account the farmers' interests in the matter of hawthorn hedges, it was decided to declare specific commercial fruitgrowing districts throughout the Dominion. The Fireblight Act, 1922, and regulations thereunder provide for this. The regulations gazetted on 19th May last comprise three schedules, each schedule provides for a different class of treatment with respect to hawthorn existing in the areas defined therein, and portions of any declared fruitgrowing district may appear in each schedule. As the uninitiated may find some difficulty in understanding the regulations set out in their legal form, the following brief explanation is offered:—

First Schedule. All declared fruitgrowing districts appear in the First Schedule of the regulations, together with details of the boundaries of each. No special treatment of hawthorn existing in areas which appear only in this schedule is called for.

Second Schedule: Should fireblight at any time spread in such a manner as to suggest the possibility of its early entry into any specific fruitgrowing district, steps may be taken, as a precautionary measure, to have all hawthorn hedges, &c., cut back in such a manner as to prevent flowering. When such a step is decided upon the whole or any specified portion of such district is first transferred from the First to the Second Schedule of the regulations. All hawthorn growing on property coming within this schedule must be cut back so as to prevent any portion of the hawthorn from flowering.

Third Schedule: Should fireblight actually make its appearance in a declared fruitgrowing district, the whole or any portion of such area may be transferred from the First or Second to the Third Schedule. In this event the regulations provide that all hawthorn existing on property coming within the Third Schedule shall be destroyed.

In given circumstances it is quite possible for portions of a declared fruitgrowing district to appear in each of the three schedules. When portions of a district are transferred to the Second and Third Schedules in the manner indicated, definite boundaries of the portions affected are set out. Hawthorn existing outside the several officially declared fruitgrowing districts is unaffected by the regulations.

—*Horticulture Division.*

SEASONAL NOTES.

THE FARM.

HAYMAKING MACHINERY.

MACHINERY for harvesting the hay crop should normally be put in repair immediately after haymaking is finished, but in cases where this was not done all the implements should be overhauled and put in order during the coming month. The grass-mower should be first attended to, as it will be required in November for cutting ensilage material and early hay crops, and mowing rank pasture-grass.

The Mower.—Many grass-mowers on farms are badly neglected, and after a few years' work cut very badly. Some people are under the impression that the knife does all the cutting, and confine their attention to grinding it. The knife section, however, is only one blade of the shears that cut the grass; the other blade is the ledger-plate of the finger-bar, and for efficient cutting both edges must be sharp and in close contact.

After a time the edges of the ledger-plates become dull and worn. Before putting a mower away the plates should be greased to prevent them from rusting. If the plates are badly worn they should be renewed. Some mowers are provided with fingers having detachable plates; in other machines, where the plate is welded in, a new finger is required when the plate becomes worn. The best sharpener for the knife sections is a grindstone, using plenty of water to keep the knife cool. Sections that are worn or ground until they are short from the point to the base will not cut clean, and the worn sections should be renewed.

Lack of contact between the knife section and the ledger-plates is a common source of bad cutting, and is usually due to some of the plates being worn and new plates on some of the fingers raising the knife off the worn ones. When putting on new fingers thin washers are often required to bring them into alignment with the old ones. The knife is kept from lifting by means of caps; these caps, however, should not be in contact with the knife, but just allow it free movement.

When the knife is at the end of its outwards or inwards stroke the knife section should lie in the centre of the fingers; if the sections do not centre, the cut is ragged and the draught is increased. This defect is usually due to the pitman not being of the correct length. Most metal pitmans allow of adjustment. Another cause of this defect is that the bar is out of alignment, which may have been caused by bending after striking some object or from continuously cutting round corners. Besides causing bad cutting, a disaligned bar causes severe wear on the knife-head.

Sweeps and Elevators.—The number of haystacks which caught fire last season in parts of the North Island makes one wonder whether the methods commonly used in stacking are altogether suitable for modern small dairy farms. It is not that the horse-sweeps and elevators are unsuitable for haymaking—this is far from being the case. It is the common ownership of the outfit, necessitating that each man's hay

be stacked by a certain time, that is at the root of the trouble. In a wet season, such as that of last year, the hay is rushed in before it is dry and large stacks are built; they are consequently liable to take fire. It would certainly pay to partially cure the hay in cocks in seasons when the weather is unfavourable. Cured in cocks, the hay retains its colour and is more palatable than when bleached by the sun.

Horse-sweeps and elevators are only suitable for haymaking on a large scale, and their use on a small dairy farm is one of the great bars to closer subdivision. It is the main cause for there usually being three 10-acre or 12-acre fields on most 50-acre and 60-acre dairy farms. These comparatively large fields allow of all the hay for the season being cut from one field, and also of the fields being alternately hayed and grazed. It is a matter for the individual farmer to decide whether the extra labour at haymaking in cocking and carting the hay is not more than balanced by the extra feed obtained by closer subdivision. If horse-sweeps and elevators are retained—and there is no reason why they should not be, provided care is exercised to stack the hay in good condition—closer subdivision could be quite well carried out were movable panels provided in the fences to allow the sweeps to pass from one field to another.

ARABLE CROPS.

Mangolds.—The more general cultivation of mangolds on dairy farms would enable many herds to be wintered more satisfactorily than they are at present. The secret of success in quickly bringing cows to their maximum production lies in fairly heavy winter feeding on hay and roots, so as to allow early top-dressed grassland to be spelled during the winter months, and utilizing this protein-rich young grass in the early spring, after the cows have calved. Excessive hay feeding in the winter is often the cause of digestive troubles in cows, and the supplementary fodder should consist of both hay and roots. Mangolds, on account of their heavy yield and comparative freedom from disease, are excellent for feeding in the winter and early spring.

On small dairy farms in the wetter parts of the North Island mangolds can be grown quite successfully without any great outlay for implements. Quite a common method is to sow the seed in beds in September and plant out into the field in October–November when the bulbs are about the size of a man's thumb. The land is ploughed early, worked down, and then reploughed when planting is done, the plants being placed on the edge of the furrows as the land is ploughed. This method is quite satisfactory as long as the plants are set out before the weather is likely to be hot and dry. When grown on a fairly large scale the use of the ridger is desirable.

Among good varieties are Prizewinner Yellow Globe, Giant Orange Globe, White Knight, White Sugar, Jersey Queen, and Red Intermediate. White Sugar germinates quickly, and this is a great advantage where weeds are troublesome. Sow at the rate of 5 lb. to 6 lb. of seed per acre, with 4 cwt. to 6 cwt. of phosphate fertilizer. Frequently 3 cwt. of salt or kainit is broadcast and worked in a week before sowing.

Linseed.—Linseed should normally be sown about the middle of October. The usual seeding is about 35 lb. per acre, but lighter seeding

—25 lb. to 30 lb.—appears to have given good results. The coulter should be set as shallow as possible and the land rolled after drilling.

Potatoes.—The main crop of potatoes should be got in during October. Potatoes do best on a well-aerated seed-bed, and the final ploughing of the land should be about a month before planting. The ground should be left in a rough state, and then broken down with a heavy grubber and levelled with the harrows just before planting.

Rape and Turnips.—Early sowings of rape, kale, and soft turnips may be made during October and November, but the main sowings will not be made till November, and the chief work to be performed in October is the working-down of the land for these and other late-sown crops such as swedes and lucerne. The nature of the preparatory cultivation for these crops depends on the class of land, the climate, and the position the crops take in a given paddock rotation. In the drier districts preparatory cultivation must be of such a nature as to secure adequate supplies of moisture in the soil for the crop. Generally summer rains do not provide nearly enough moisture for the production of a good crop, and the plants must draw upon the reserves and supplies held in the soil and subsoil. In dry districts, therefore, it is important to plough or stir the land intended for roots in the early winter, so that the rain may readily enter the ground. If the land is ploughed and left in unbroken furrow slices over the winter the rain runs quickly through the top soil and enters the subsoil, and there is little loss by evaporation. Further, this early cultivation, by its exposure of the soil to weathering influences, will lessen the amount of spring cultivation necessary, and thus reduce the amount of moisture lost during the spring cultivation.

—P. W. Smallfield, *Instructor in Agriculture, Ruakura.*

THE ORCHARD.

SPRAYING.

At least two sprays should have been applied on apple-trees up to the open-cluster period, as referred to in last month's notes. Many growers, in fact, now try to get three sprayings of lime-sulphur on before this stage, the idea being to keep the trees and foliage well covered with a film of spray in order to prevent the germination of any spores of fungus diseases, also to cope with the insect pests that may become active as the warmer spring weather advances. These first sprays are a distinct advantage in the control of red mite, a pest that is becoming a very serious one in many orchards. The elimination of the eggs of red mite, which at this season of the year will be nearing the hatching stage, will do much to prevent a recurrence at a later period when the fruit is reaching maturity and when growers are specially busy making preparations for the harvesting of the crop.

The next stage in the development of blossom-buds is known as the "pink"—undoubtedly an important period and one that should not be missed as far as spraying is concerned. From this stage onward a good many of the orchardist's troubles commence, and consequently thoroughness and efficiency should be the first consideration. It is fully realized

that all varieties of apples do not reach the same stage of development at the same time ; therefore it is more difficult for the orchardist to arrange a set spraying programme. But every effort should be made to apply the spray at the right stage if success is to be attained. As an example, when Cox's Orange and Sturmer are at the open-cluster period Delicious is only at tight-cluster and Worcester Pearmain will be barely beyond the green-tip stage. It often means that when spraying at the pink stage there will be continual dodging backwards and forwards throughout the orchard, instead of a straight run through ; but better this than neglect to spray any variety at the right stage of development. Lime-sulphur applied at the pink stage at strength 1-60 will be beneficial. Personally, I like two sprayings during the pink period, the first at strength 1-60 just as the pink is showing, and again, in about a week's time, at the advanced pink stage, using strength 1-80. Care should be taken not to spray the trees when in full bloom. Many growers have done this in the past with no apparent ill effects. On the other hand, reports received in other cases have indicated that damage has been done.

Fruit-trees should be kept as dry as possible during the blossoming-period, so that bees and insects, attracted by the bright colours and faint aroma, can function properly. Many of our varieties are self-sterile or only partially fertile, requiring cross-pollination to ensure the setting of a good crop. It is a well-known fact that wet weather during blossoming often results in a poor set ; how much more so if the blossoms are covered with a spray that is obnoxious to these friends of the grower—the bees ! A good spray, thoroughly applied at the advanced pink period, will carry over until the next stage of development—that is the petal-fall or calyx stage, full notes on which will appear in next month's *Journal*.

Pears will be more advanced than apples, their stage of development being earlier. As soon as the fruit is set it is advisable to spray with bordeaux, 3-4-50, on varieties that are subject to black-spot, taking care to do the work thoroughly, as this is about the time when black-spot usually appears. The less susceptible varieties can be given an application of lime-sulphur at strength 1-80 to 1-100. The addition of arsenate of lead—1½ lb. powder or 3 lb. paste per 100 gallons—at this period should keep any attacks of codlin-moth well in check.

Stone-fruits also will have their fruit well formed by this time, and spraying must be continued as a preventive against brown-rot, leaf-curl, &c. Lime-sulphur, 1-120, has been proved very successful. The addition of 3 lb. to 4 lb. of atomic sulphur will help considerably, and a spreader is recommended from this stage onwards. Should green or black aphid put in an appearance and not be controlled by the lime-sulphur spray, the addition of Black Leaf 40 will ensure success.

CULTIVATION AND MANURING.

The season is advancing, and the application of fertilizer—if not already attended to—should be completed, especially with quick-acting phosphate, as this class of manure is needed as soon as the trees break into growth. Any weak-growing trees in the orchard should be specially attended to, a little extra manure often resulting in restoring vigour.

From 2 lb. to 4 lb. of phosphate per tree, according to condition, should suffice. This should be well spread, not directly round the trunk of the tree, but over the whole rooting-area.

The cultivation of the soil during the spring is most necessary, and should be attended to as soon as the weather permits. Not only will a good tilth be produced, but the soil will be aerated and moisture conserved in the subsoil for the drier periods which follow during the summer. If neglected until later in the season many soils set hard, making it very difficult for any implement to break through the surface. Poor cultivation often means trees making little or no growth, and loss of fruit and foliage.

—G. Stratford, Orchard Instructor, Motueka.

Citrus-culture.

Pruning: When danger from frost is over, the tops of trees which have been damaged may be cut back to good, sound growth. At this season it is well to remove all excess growth which has been made on the inside of the trees, also any wood which has been injured by excessive rubbing or disease. All the largest cuts should be made clean, and coated over with coal-tar. While pruning, an inspection should be made for borer infection. The smaller infected twigs should be cut out, but with larger limbs and the trunk benzine should be injected into the burrow and the outlet blocked with soap or putty.

Cultivation: Spring cultivation should be carried out to a depth of at least 6 in. right under the trees, and as deep as possible between the rows. This will assist in forcing the rootlets to a greater depth, and ensure a more equable moisture in the soil during summer.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

CARE OF BROODER CHICKS.

STRICT attention to details is the great determining factor in successful poultry-keeping, and there is no matter of greater importance than avoiding late-hatched stock on the plant. This being so, every effort should be made to get the last of the eggs for the season under incubation as early as possible.

In recent notes some advice was given regarding the common causes of mortality in chicks during the brooder stage, but it is as well to again emphasize the necessity of their not being subjected to extremes of temperature. Usually, the later in the season the chicks are hatched the greater is the loss from this cause. It is common for poultry-keepers to work their brooders in exactly the same manner in October and November as during the early season, when heavy frosts are often experienced. This is a mistake. During the early season the weather conditions are more uniform than is the case later, and because of this uniformity the desired degree of temperature and ventilation demanded by the chicks in the brooder can be easily controlled. With the

approach of summer, however, extreme variations of climatic conditions are often experienced, and it is these that must be guarded against.

It frequently happens that a warm night follows a cold one, and that is where the chief danger lies. This is chiefly because the chicks become overheated at night, and in leaving the brooder next morning the extreme change of temperature proves too much for them, resulting in chill and its consequent troubles—white diarrhœa, droopy wings, &c. It will thus be seen that as the season advances the greater must be the attention to ensure that the young birds are provided with a uniform degree of warmth and the necessary fresh air for their welfare.

DRYING DOWN AFTER INCUBATION.

In the artificial hatching of chicks it is generally accepted that the young birds should not be moved from the incubator to the brooder for at least twenty-four hours after being hatched. This is because if the chicks are transferred before they are thoroughly dried off they are highly susceptible to chill. While some poultry-keepers adhere closely to this rule, they make the mistake of not drawing away the water in the moisture-pan which is supplied with most incubators. Very often added moisture, especially during dry weather, is an essential to assist the hatching process, but it is of no use whatever after it has served this purpose. As soon as the hatch is cleaned up all moisture should be withdrawn, as obviously the chicks will not thoroughly dry down if compelled to remain in a humid atmosphere.

As a further means of assisting the drying-down process the ventilators should be opened wide, while it is also a good plan to open the incubator-door about $\frac{1}{8}$ in. for an hour or so before the chicks are removed to the brooder. Of course, special care should be taken to arrange the door in such a way that it will not fall downwards, or serious trouble may result.

ACTION AGAINST VERMIN.

Now that the warm weather is approaching, vermin are apt to multiply in abundance. Even if one is certain that there is no vermin in the poultry-house it is always wise as a preventive to adopt the same necessary measures as if they were present. This means that the perches must frequently be given an application of pure kerosene or strong disinfectant. The nesting-material should be renewed as often as possible, and, above all, the quarters should be maintained in a thorough sanitary state. Dust baths, which are the natural remedy, should be provided to enable the birds to rid themselves of body-lice. No flock can produce the maximum number of eggs if the houses are infested with vermin—particularly that great enemy of the fowl, the red mite.

WOMEN AND POULTRY-KEEPING.

An important movement is being set on foot by certain women's organizations in the North Island for taking advantage of the assistance given by the Department of Agriculture to foster the poultry industry. The aim of these organizations is to arrange meetings in the various districts whereby any women interested in poultry-keeping

may be afforded an opportunity of attending lectures and demonstrations by the Poultry Instructors. No doubt the spread of the movement throughout the country districts would not only do much towards creating interest in poultry matters, but also prove of great educational value to those concerned, and in due course tend to increase the poultry products of the Dominion.

It is very satisfactory to know that farm womenfolk are among those responsible for instituting the organizations referred to, and are taking full advantage of the opportunity afforded of gaining knowledge in connection with the various branches of poultry-management. The interest created in the districts where lectures and demonstrations have already been given is indicated by the fact that requests for our poultry publications are frequent, while inquiries for the Department's utility stock and eggs for breeding purposes are constantly on the increase.

LARGE-SCALE AND SIDE-LINE POULTRY-KEEPING.

Some people are advocating that poultry-keeping should be recommended as a sole means of livelihood and not as a side-line. This contention would be all right in its way if the question of managing a large flock profitably were as simple as it is now difficult. The knowledge of how to make poultry profitable on a large scale is certainly available, but it is essential that such knowledge should first be tested out in practice. Obviously it would not be advisable for the average person to do this at the outset on a large scale. Gaining experience in a small way as a side-line, and extending the plant as warranted by the increased knowledge gained, is the only safe course.

As regards large plants, it is satisfactory to know that these are on the increase throughout the Dominion, as shown by the latest census returns. These go to show that in 1921 there were ninety-six persons keeping flocks of from 500 to 999 birds, while in 1926 the number of such owners had increased to 148. In 1921 there were forty-one plants carrying 1,000 birds and over, while the number in 1926 stood at sixty-six.

It is safe to say that the great majority of those conducting these large poultry plants find the business a profitable undertaking. With the necessary aptitude and knowledge concerning control and management they are enabled to work even to the extent of increasing their present stock on assured lines. Because these men possess the essential qualifications for the successful management of a plant it should not be thought that any one possessing a mere insight of the business can do likewise. For people with no knowledge of the industry to take up the business as a sole means of livelihood would be nothing short of courting disaster. The increasing number of large plants which have been established has been brought about in a natural way, and generally by the type of man well fitted for the business. For the welfare of the industry it will be well to allow the expansion of future large plants to develop along similar sound lines as hitherto. If those who are at present successfully conducting large plants could be induced and encouraged in every way to increase their flocks it would undoubtedly be a means of increasing production and consequently placing the export trade in eggs on a sound footing.

Hitherto the great bulk of the eggs and table poultry has been produced as a side-line by the small settler on the land and the suburban resident, and it will continue to be so, because on such places poultry products can be produced at the lowest cost. The best proof of the increasing popularity of side-line poultry-keeping is the fact that according to the last census the number of householders keeping poultry in the Dominion had increased by 11,102 between 1921 and 1926.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

SEASONAL PREPARATIONS.

OCTOBER is perhaps the month when the apiarist can do most to help his bees to work up to full strength in time for the main honey-flow. In the warmer parts of the country swarms may be looked for about the middle of the month, but in the southern districts they will probably not appear until three or four weeks later. By 1st October, unless the weather for some weeks has been cold and wet, every hive should have been examined and its condition noted with regard to stores, population, and health.

No colony should be allowed to dwindle because it has not sufficient food to provide for the offspring of a prolific queen. On the other hand, some beekeepers prefer that all the old honey in the hive should be used up before the new season's flow commences. The food-supply of the hive is sometimes an exceedingly puzzling matter, as it varies considerably in accordance with the weather and the strength of the colony, and only periodical and systematic examinations can settle the question as to whether all is well with the hives in this respect. No harm can be done by feeding good white-sugar syrup, but a hive which is starved in the spring will probably not recover its strength till the main honey-flow is nearly over. By the middle of October, under normal weather conditions, every hive should have at least four frames of sealed brood, and many will have more. Those that have fewer, unless their food-supply is very short, should be marked for requeening as soon as possible. The apiarist's endeavour should be to keep his colonies as even as possible, thereby obtaining a uniform surplus throughout the apiary.

Wherever there is a fair yield of nectar from spring flowers the beekeeper would do well to take advantage of the warm days of the month to treat any cases of foul-brood which he may have noted earlier in the spring. However, no hard-and-fast rule can be laid down in this matter, everything depending on locality and weather conditions. In some districts it would be almost suicidal for the beekeeper to treat his bees in October; in others, where right conditions prevail, it may be carried out with ease and safety, and the bees brought into good condition by the time a surplus may be expected. Wherever treatment has been undertaken the colonies should be watched in order to see that there is no danger of starvation, and where the spring flow is not considered heavy enough it should be supplemented by liberal

feeding. For full details see Bulletin No. 119, "American Foul-brood and its Treatment." This is issued free, and can be obtained from any of the Department's offices.

HIVING SWARMS.

In most text-books on beekeeping this kind of advice is given: "When a swarm settles into a cluster take a light box and shake the bees into it," &c. Such advice is all right where the bees are accommodating enough to settle into a convenient position for the shaking process to be carried out. Unfortunately, in many cases bees get into positions whence it is impossible to dislodge them so easily. Sometimes they will settle on a small bush, and much of the cluster will be on the ground. In this case probably the best thing to do is to place the box over the cluster, and if the bees do not show much disposition to climb up into the box they may be persuaded to do so by the use of a little smoke. When they cluster in the centre of a prickly hedge the box should be placed on one side of the hedge, and the beekeeper should puff smoke from the other side of the hedge, and thereby drive the bees towards the box. In the event of the swarm taking possession of a fencing-post and clustering on it from top to bottom, as they occasionally do, the smoker must again be used, and in addition it is as well to brush the bees from each side of the post in turn into the swarm-box, with the brush used for the frames at extracting-time.

The usual practice is to leave the box sheltered from the sun and covered with a sack near the place where the swarm has settled. Where few hives are kept this may be done with impunity, but if other swarms are expected it is well to remove the box to the place where the colony is to stand permanently, otherwise before the close of the day the probabilities are very largely in favour of the box being taken possession of by three or four other swarms—a matter of annoyance to the man who wishes to keep his swarms separate.

In every case a swarm should be attended to as soon as it settles. Many people are under the impression that swarms should be left undisturbed till nightfall, but this idea is an erroneous one. They should invariably be placed in the box as soon as possible after the cluster is formed, and put so that they are sheltered from the rays of the sun.

WATER-SUPPLY.

One of the most important of the minor details of apiculture is the provision of a constant water-supply for the purpose of assisting the bees in brood-rearing. Not only is it necessary to conserve the energy of the bees by having the water close at hand, but it is well to ensure that they do not prove a nuisance at taps, cattle-troughs, &c. From early spring till late autumn water is an absolute necessity to bees, and they will consume comparatively immense quantities in fine weather. It thus behoves the beekeeper to see that a liberal supply is always available. By establishing his drinking-fountain early in the season he will teach the bees where to go for supplies, and ensure their always seeking the same spot for water.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

THE TOMATO CROPS.

THE success of the indoor tomato crop depends very largely on the skill and attention given now. The main object at present is to keep the plants growing steadily, and take care that they receive no check. These plants are sometimes checked in growth at this period by deep cultivation interfering with their roots; by the ventilators being left open too wide during a cold snap; or by applying water at too low a temperature. It is just now that the plants require very careful nursing and regular attention to tying and suckering. When the warmer weather arrives and outdoor conditions are suitable the necessary supervision is much reduced, but meanwhile the quantity and quality of the early crop depend on the attention given at present.

In the warmer districts the outdoor tomato crop is planted out towards the end of October, but nothing is gained by straining this point. It is unwise to put the plants out until the temperatures are safe. Meanwhile the young plants in the frames or houses will require the same careful treatment as the indoor crop. Ventilate the plants when the weather is warm, and keep them close when it is cold and stormy. That is a very obvious statement, but much harm is done to plants every season by neglecting this primary attention. It is, of course, a busy time, but this attention is necessary, and is best met by making it the duty of one person, and placing the frames in as handy a position as possible. Most of the troubles with the young plants are due to their being grown too quickly in a high temperature and a moist atmosphere, when they become a prey to *sclerotinia* and fungi known as "damping off." With attention, sturdy plants are grown which are easily hardened off later without injury, and are ready to go out into the field at the earliest date without suffering a set-back. The plants are best given one or two bordeaux sprays before planting out, with an interval of about a fortnight. Examine the plants carefully and discard any that show the least sign of disease.

SMALL-FRUITS.

Cape gooseberries, peppers, and egg-plants require attention somewhat similar to that advised for tomatoes. The brakes of bush fruits will need light cultivation in bright weather to keep the weeds down. Strawberry-beds will require spraying with bordeaux where leaf-spot fungus is present; destroy runners and weeds, and give a dressing of nitrates before laying down a straw mulch. Newly planted passion-vines are trained to one stem by pinching out the growing point of laterals; tie the plant to the stake as it grows, until it reaches the horizontal wire.

Preparation of the land for the before-mentioned half-hardy crops (including outdoor tomatoes) should now be completed, harrowing in a dressing of suitable manures a week or two before planting out.

TOBACCO-GROWING.

As the tobacco-plants in the seed-beds attain a size near that required for transplanting they should be hardened by gradually

giving them more air and less water. Avoid sudden changes by removing the cover for a few hours in the morning or on a dull day for a commencement, gradually accustoming the plants to full sunlight and natural conditions, protecting them only in the case of extreme weather conditions. Just before they are ready, spray the plants well with any remedy that may be necessary, and give the beds a good watering the day before planting, so as to facilitate lifting the roots without damage. Lift the plants with as much root and soil as possible, and place them in an upright position in trays for carrying into the field. If dull weather is not available for the work of planting out, it is best done as far as possible during the afternoon.

Plants in the seed-beds now that are making good progress must not be forced with manures, for fear of making them soft and delicate, but if they stop growing and show a tendency to harden they should be encouraged to make growth by feeding them with fertilizers.

Towards the end of October the preparation of the land where the plants are to be grown should be completed by an application of such fertilizers as may be required. The tendency now in planting is to widen the distance between rows and lessen it between plants—a method that gives increased facilities for the later field operations without damage to the leaves; $3\frac{1}{2}$ ft. between the rows and $2\frac{1}{2}$ ft. or less between the plants is about right. For this method of planting a line is marked out with sighting-rods where a row of plants is to be placed, and a furrow is struck with a hand-plough; into this furrow the young plants are placed at regular intervals, and the roots then firmly covered.

Every effort should be made to commence planting out early in the season, so that the crop may ripen in warm weather. It will then be of better quality, and be more easily cured than that ripening later.

VEGETABLES.

Main-crop beetroot, carrots, peas, and spinach should now be sown, and late potatoes, cauliflower-plants, and rhubarb planted. As the weather warms, sow marrows, pumpkins, ridge cucumbers, and French, runner, and wax-pod beans. Towards the end of October—for planting out early in the New Year—sow the following important winter crops: Savoy and red cabbage, cauliflower, broccoli, kale, main-crop celery, and leeks. Continue to feed the asparagus-beds monthly with dressings of salt or fertilizers.

LAWNS AND GREENS.

Much attention has been given recently in America and England to the use of sulphate of ammonia on lawns in the spring. Experiments there have shown the advantage of giving at that season fortnightly dressings of this manure mixed with twice its volume of sand, and applied at the rate of 5 lb. to 1,000 sq. ft. (say, $2\frac{1}{2}$ oz. to 1 square yard). Unless the weather was showery the dressings were watered in. The result was that weeds and clovers quickly disappeared, and a sward of fine grasses was obtained. This treatment deserves a careful trial here by all who realize the use and beauty of fine lawns.

—W. C. Hyde, *Horticulturist, Wellington.*

AGRICULTURAL RESEARCH ABROAD.

DR. REAKES'S MISSION.

DR. C. J. REAKES, Director-General, Department of Agriculture, left Wellington on 27th August for London, where he will represent New Zealand at the Imperial Agricultural Research Conference, which opens on 4th October. The following statement regarding the Conference and Dr. Reakes's further programme of investigation abroad was made before his departure by the Hon. O. J. Hawken, Minister of Agriculture :—

The proposal to hold the Conference originated with the Agricultural Research Council in Great Britain, a body composed mainly of directors of agricultural research institutes in England, Wales, and Scotland, on which also the Ministry of Agriculture, the Board of Agriculture for Scotland, the Development Commission, and the Department of Scientific and Industrial Research of Great Britain are represented; and when the Secretary of State for Dominion Affairs submitted it to the New Zealand Government it was cordially approved. The delegates to the Conference will consist principally of workers engaged on agricultural research and officers responsible for the administration of agricultural research in the various parts of the Empire. The cost of the Conference itself is being borne by the Empire Marketing Board, and it is expected to last about four weeks, including visits to research institutes, &c.

New Zealand will be represented by Dr. C. J. Reakes, Director-General of Agriculture. In addition, Mr. T. Rigg, of the Cawthron Institute, who left New Zealand some time ago for America and England, is also expected to attend the Conference for part of the time, if not throughout. The Imperial authorities have advised us of the proposed itinerary in connection with the visits to the various research institutes, &c. Among these are the Rothamsted Experimental Station, the Animal Nutrition Institute, and the Plant Breeding Institute, Cambridge; the Animal Breeding Research Department, the Scottish Plant Breeding Station, and the Scottish Animal Diseases Research Station, Edinburgh; the Dairy Research Institute at Reading; the Animal Pathology Research Institute at the Royal Veterinary College, London; the Ministry of Agriculture Veterinary Laboratory, Weybridge; the Foot-and-mouth Disease Research Station at Pirbright; the Agricultural Economics Research Institute at Oxford; the Plant Breeding Station at Aberystwyth, and the Rowett Animal Nutrition Research Institute at Aberdeen.

Dr. Reakes will also visit Leeds and Bradford, in order to inquire particularly into matters relating to New Zealand wool and to discuss the wool question generally with Professor Barker of Leeds University, with whom the Department has been in correspondence, and to whom sample fleeces of New Zealand wool have been sent.

A special feature of his inquiries and investigations in the United Kingdom and in other countries will be in connection with diseases of dairy cows, which are causing particular trouble in New Zealand as well as in many other countries, and the opportunity of getting into personal touch with those carrying out scientific investigation in connection with these diseases will be most valuable. The work being done in Great Britain, particularly at the Rowett Institute, in connection with mineral contents of pastures and with animal nutrition generally will also be the subject of close inquiry, and it is anticipated that a great deal of good information regarding these will be obtained.

Close inquiry will also be made into the existing conditions regarding foot and-mouth disease and the research work which is going on in connection with it. The question of the possibility of reopening the export trade in stud stock from Great Britain into New Zealand will receive close attention. Matters relating to our meat-export trade will also be gone into.

Dr. Reakes will give special attention to agricultural education and to the work being done in this direction in agricultural colleges in England and Scotland,

so that any features connected with this which are likely to be of value to us in New Zealand can be made available for those dealing with agricultural education here.

After completing his investigations and inquiries in England he will visit Denmark, Holland, Belgium, and France. In Denmark and Holland particularly a great deal of information should be gained regarding dairy matters; also regarding dairy-cow diseases and the methods of preventive and curative treatment adopted. The progress of agricultural education will also be gone into. In France special matters for inquiry will include the results so far obtained from Dr. Calmette's method of protective inoculation against tuberculosis. Thanks to the courtesy of the Pasteur Institute authorities, some of Dr. Calmette's cultures were obtained some time ago for the Wallaceville Laboratory, where work upon them is being done with a view to testing the method in New Zealand.

Dr. Reakes will also endeavour to meet Dr. Voronoff, and obtain first-hand information regarding the results of his gland-grafting operation as applied to farm animals. He hopes also to visit the agricultural and veterinary colleges and research institutions in France, where it is understood very good work is being done.

He will return to New Zealand via South Africa, where he will make special inquiry into the work being done in connection with the control of and research into animal-disease. The Union Government of South Africa maintains a particularly well-equipped and strongly staffed veterinary research laboratory near Pretoria, and it is anticipated that a great deal of very valuable information can be obtained there.

He will also visit Rhodesia for the special purpose of obtaining first-hand information regarding a special type of vaccine for contagious abortion in cows, which is reputed to have met with a considerable measure of success in that colony. A beginning has been made to test this vaccine in New Zealand, and the information Dr. Reakes hopes to obtain in Rhodesia should prove of great assistance to our workers in New Zealand. This particular vaccine seems to hold out some promise, and it is certainly free from the serious objection of converting inoculated animals into "carriers" of the disease, which has rightly prevented us in New Zealand adopting the use of a live vaccine that was at one time credited with giving good results but now seems to be going out of favour.

From South Africa Dr. Reakes will return to New Zealand, where he expects to arrive about the end of February or the beginning of March.

IMPORTATION OF PIGS.

OWING to the presence of certain diseases it has been necessary for some time past to place an embargo on the importation of pigs from Britain and Australia. Recognizing the importance of new blood being obtained by breeders, the Minister of Agriculture has now decided to allow, during the next few months, the importation of pigs from Canada, subject to the following conditions:—

(1) The written consent of the Minister of Agriculture must be obtained before each shipment is made. Applications for such consent must give full particulars of the pigs proposed to be imported, of the probable date of shipment, and of the owner's name and locality of the farm from which they are to be obtained, in order that full inquiry may be made before consent is given.

(2) If a permit is granted it will be subject to the shipper in Canada giving a statutory declaration that the animals have been in Canada from birth, that they have been free from all contagious disease for six months, and that they have not been in direct or indirect contact with any infected live-stock for six months. They must also be accompanied by a certificate from a qualified veterinarian, and on arrival in New Zealand will be held at one of the island quarantine stations of the Department of Agriculture for forty days.

An Order in Council giving effect to this decision will be gazetted shortly.

WEATHER RECORDS : AUGUST, 1927.

Dominion Meteorological Office

GENERAL SUMMARY.

THE outstanding meteorological feature of August was the frequency with which cyclones passed over or in close proximity to the Dominion, while well-defined high-pressure systems were conspicuous by their absence.

From the 10th to the close of the month there was practically a succession of these cyclones, but, with the exception of one which ruled between the 18th and 21st, they were of a shallow type, accompanied by much rain but little wind. On the 18th and 19th, while the centre of the latter intense disturbance was passing over the North Island, particularly stormy conditions and heavy rain were experienced in the North Island and on the east coast of the South Island.

Except in the Gisborne and Napier districts in the North Island and the western, central, and southernmost portions of the South Island, both the aggregate month's rainfall and number of wet days were above the average.

The general character of the month may be described as dull and moist, with an absence of strong winds. Although frosts were frequent, there were few damaging ones. Conditions generally were favourable to a fair growth of grass.

RAINFALL FOR AUGUST, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall	Average August Rainfall.
<i>North Island.</i>				
	Inches		Inches.	Inches.
Kaitiaki	6.26	23	1.14	5.10
Russell	4.98	19	0.76	5.07
Whangarei	6.23	24	1.19	6.85
Auckland	6.96	26	1.21	4.19
Hamilton	8.80	20	1.80	4.02
Kawhia	7.84	21	1.57	4.60
New Plymouth	8.68	23	1.50	5.20
Riversdale, Inglewood	11.69	26	1.79	8.65
Eltham	10.49	22	2.50	3.82
Whangamomona	8.97	18	1.15	5.80
Tairua	7.26	23	1.60	6.98
Tauranga	9.72	21	2.27	4.08
Maraehako Station, Opoiki	8.46	16	1.94	5.20
Gisborne	3.09	15	1.00	4.55
Taupo	5.69	12	1.53	4.23
Napier	2.15	13	0.96	3.57
Maraekakaho Station, Hastings	2.99	16	1.61	3.31
Taihape	3.22	21	0.42	2.73
Masterton	4.54	19	0.90	3.33
Patea	5.10	21	1.09	3.57
Wanganui	3.87	15	1.02	2.73
Foxton	3.48	14	0.50	2.89
Wellington	7.38	23	1.03	4.43
<i>South Island.</i>				
Westport	6.53	19	1.40	6.26
Greymouth	5.62	16	1.09	7.53
Hokitika	7.42	18	1.46	9.34
Ross	6.74	14	1.18	10.40
Arthur's Pass	7.73	15	1.92	12.78
Okuru, Westland .. ..	..	..	..	11.46
Collingwood	8.50	21	1.44	6.96
Nelson	7.40	18	0.88	3.02
Spring Creek, Blenheim	4.91	18	0.90	2.73

RAINFALL FOR AUGUST, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
<i>South Island - continued.</i>				
	Inches.		Inches.	Inches.
Tophouse	3.99	13	0.90	4.64
Hanmer Springs	7.37	12	1.64	2.56
Highfield, Waiau	4.40	12	1.16	2.26
Gore Bay	6.20	12	2.25	2.12
Christchurch	2.71	15	0.97	1.83
Timaru	1.30	11	0.32	1.41
Lambrook Station, Fairlie	1.40	9	0.50	1.43
Benmore Station, Clearburn	0.90	11	0.25	1.50
Oamaru	1.75	11	0.56	1.71
Queenstown	0.74	4	0.36	1.93
Clyde	0.55	6	0.29	0.80
Dunedin	4.02	18	0.90	3.14
Wendon	1.73	9	0.46	2.08
Gore	2.71	10	0.59	2.34
Invercargill	1.64	16	0.26	3.31
Puysegur Point	4.13	16	0.50	7.20

—E. Kidson, Director.

EXPORT OF PEDIGREE LIVE-STOCK FROM BRITAIN.

A REPORT issued by the Empire Marketing Board, London, on the progress of its work during the year ended June last, contains the following statement on this subject —

“One of the principal recommendations in the First Report of the Imperial Economic Committee was that grants should be made out of the Empire Marketing Fund to assist the export of pedigree live-stock to the overseas parts of the Empire. Owing to the prevalence of foot-and-mouth disease in Great Britain, export has been suspended in recent months; but representations were made to the Board by the Royal Agricultural Society of England that the establishment of one or more quarantine stations, through which stock could safely be passed for export to Dominions and colonies, might enable overseas Governments to relax their restrictions on importation. A detailed scheme for the establishment of portal quarantine stations was prepared by the Royal Agricultural Society with the assistance of the Ministry of Agriculture's veterinary experts, and an application was made to the Board for a grant to cover the necessary capital and overhead maintenance charges. The scheme provided for the administration of the English stations by the Royal Agricultural Society, and for their close inspection by the Ministry of Agriculture.

“On being informed that the South African and Southern Rhodesian Governments were willing to admit stock forthwith on the conditions laid down in the scheme, the Board decided to approve the necessary expenditure, and a quarantine station will be established in London at a very early date. In the meantime other overseas Governments are being consulted as to the conditions on which they would be prepared to permit the use of further stations if opened, and the possibility of establishing stations at Glasgow and Liverpool is being explored. The most stringent precautions will be taken by the Ministry of Agriculture for ensuring efficient quarantine methods, and the importing Governments will retain full control over the admission of animals to the stations for export to their own territory. The scheme, which is devised in the interests of home and overseas producers alike, has the hearty support of the principal breed societies, and promises to be a contribution of great value to the Empire's live-stock industry. The Board is now considering whether, and, if so, in what form, a further contribution should be made from the Empire Marketing Fund towards the actual cost of exporting animals to overseas parts of the Empire.”

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

BANDY-LEGGED LAMBS.

“MACKENZIE COUNTRY,” Timaru :—

What is the cause of bandy-legged lambs? Could you suggest anything that could be given the ewes and lambs to eat that would be a preventive? To be of any use it would need to be a practical suggestion, so that it could be put into practice by a person holding, say, 10,000 acres of pastoral country; or something that could be given the sheep in the same manner as we give them rock salt.

The Live-stock Division :—

This bandy-legged condition is one of the symptoms of rickets or deficiency disease. Among the causes is poorness of the phosphate and lime content of the mother's milk, but the condition is chiefly met at weaning-time, when lambs are being fed on pastures the herbage of which is deficient in available lime and phosphoric acid. One preventive is to top-dress some of the better pastures on the run with superphosphate and lime, and to give all the stock periodic spells on this top-dressed country. Lacks of which superphosphate and bonemeal form a part are useful in this connection, but before such could be definitely recommended it would be necessary to know exactly in what respect the deficiency exists, as mineral salts other than those mentioned may also be lacking.

MIXING OF LIME AND SUPERPHOSPHATE.

J J., Manurewa :—

A belief is very generally held by farmers that if lime and super are mixed a few days previous to drilling, chemical action is set up that makes the mixture very much more effective than when mixed immediately previous to drilling or when drilled separately. Is there any scientific basis for this belief, or has your Department any evidence in support of it?

The Fields Division :—

Field evidence does indicate that on certain soils lime and super mixed a few days previous to drilling do give better results than when the two ingredients are used separately. The scientific reason ascribed is that when applied to soils with a fair proportion of alumina present superphosphate reverts rapidly to aluminium phosphate. In this form it is less readily available to crops than when reverted by lime. Large areas in Waikato go into this group of soils, and from knowledge of Manurewa—that is, if you are on the heavy clay loam—your soil would also be in the same category. On soils such as the red volcanic soils of Auckland Province a good deal of iron is present, and this reverts the soluble phosphate in the super. In this form the phosphate is less soluble, and therefore less available to plants than either the aluminium or lime combination.

REDWATER AND HÆMATURIA IN CATTLE.

“XJ,” Tutaki, Murchison :—

I have a bullock suffering from redwater. He has been running on rough hill country. What is the cause of this disease, and can it be cured? Is it infectious?

The Live-stock Division :—

For about ten or twelve years settlers in the area between Reefton and a little north of Murchison have made occasional and periodical inquiries regarding treatment for redwater. During the past two or three years, however, investigations have proved that a proportion of the cattle (especially milking-cows) in that area are annually affected with a disease known as hæmaturia (bloody urine).

This disease is readily mistaken for what is generally called redwater, and probably your bullock is similarly affected. Hæmaturia has been investigated in several countries, and so far it appears not improbable that it may result from the oxalic-acid contents of the herbage on which the cattle are allowed to graze for some time, or it may be some toxic substance in the pasture. Several forms of treatment have been suggested, but these have not been sufficiently successful to warrant their recommendation. However, experience in France, British Columbia, and elsewhere has shown that following agricultural improvement—such as better drainage, top-dressing with lime and manures, &c.—in the affected areas the disease tends to disappear. Hæmaturia is not considered to be either infectious or contagious. The urine of affected animals may be red or brown in colour, and blood-clots may also be passed. There is a form of redwater which is contagious, this being caused by a parasite in the blood; but, fortunately, this trouble has not so far appeared in New Zealand. Another form of redwater is caused by dietetic errors, such as feeding cows heavily on turnips just before calving, &c. In this form strong doses of common salt in addition to tonics have been used successfully. Further particulars regarding chronic hæmaturia may be obtained from an article published in the *Journal* for August, 1926.

CONVERSION OF RATSTAIL GRASSLAND.

J. C. MCGREGOR, Waimana, Opotiki :—

Referring to the article on destruction of tall couch in Marlborough which appeared in the May *Journal*, I would like advice on the following matters. (1) Would the smothering-crop prove as successful if applied to ground (ploughable) which is grassed almost entirely with ratstail? (2) Is there any difficulty in getting the smothering-crop—Algerian oats and Scotch tares—to ripen simultaneously? There are no threshing-mills in this district, so I would have to hand-thresh, and propose using grain and tares as pig-feed. I presume in districts more scientifically farmed the mills separate the two seeds. My ultimate object is to get the land, which is virgin, into good cow-pasture. The soil is river-silt, 6 in. deep, with shingly subsoil, the country is well drained and has a good rainfall.

The Fields Division :—

Tall couch (*Agropyron repens*) is much more aggressive and harmful than ratstail, since it persists in spite of good cultural and cropping methods, and unless it is eradicated completely before putting the land down to grass it is likely to cause trouble. With ratstail, however, it has been found that even when it appears on grassland it can be subdued by top-dressing and good management, hence drastic measures such as allowing the smothering-crops to seed are not necessary. An ordinary smothering-crop of Algerian oats (3 bushels) and spring tares (1 bushel), sown in spring and fed off in late summer, would be a good preparation for the autumn sowing of grass. The following grass mixture is recommended for your country: Cocksfoot, 8 lb.; Poverty Bay rye-grass, 10 lb.; Italian rye-grass, 4 lb.; crested dogstail, 4 lb.; timothy, 3 lb.; meadow-foxtail, 1 lb.; cow-grass, 3 lb.; white clover, 1 lb.; total, 34 lb. per acre. Basic super at 3 cwt. per acre should be sown with the mixture. There would be great difficulty in harvesting Algerian oats and Scotch tares, especially as you have no grain-mill in the district. In Marlborough the tares only were harvested for seed, since the oats acted more as a support for the tares than as a grain-producing crop. If you have a herd of cows, it would be a good plan to feed off the green smothering-crop. As green feed it would be found most useful, and quite equal to the purpose of subduing the ratstail.

ACUTE IRRITATION OF DOG'S FEET.

R. S. ALLAN, Whangarei :—

I own a valuable collie dog, and for some months he has been suffering from sore feet. There are no actual sores on the feet, but they are in an intense state of irritation, and he is constantly gnawing and biting them, almost tearing off the pads. We have bathed them in bluestone solution, but without effect. Can your veterinary branch tell me the cause and the remedy?

The Live-stock Division :—

All breeds of dogs are subject to similar complaints, but breeds with much hair between the claws are more subject, the condition being usually associated

with inflammation between the claws and pads. Probably if you examine closely you will find that this is so. Often the inflammation is associated with an eczematous condition or a cyst between the claws, and this would require surgical treatment. We would advise you first of all to clip the hair carefully between the claws and pads, and thoroughly clean and sponge out with a weak solution of lysol and warm water; then, after everything is clean and dry, dress once with tincture of iodine. Subsequent treatment which might be given would be to sponge or bathe with one part hydrogen peroxide and three of warm water. Do this daily, and afterwards apply a little ointment consisting of equal parts of zinc and boracic ointments. It may be necessary to make a boot out of a piece of stout calico to put on the foot, but this is likely to be torn off unless a muzzle is placed on the dog until it gets accustomed to the boot.

DEVICES FOR BURNING OFF SCRUB.

"SECOND GROWTH," Opatiki :—

Could you tell me if there is any efficient article made for carrying fire for burning off second growth (manuka, fern, &c) in a condition rather too thin to carry a fire very freely? I often use a flax-stick dipped in kerosene, but the flame is not big enough unless the scrub is very dry and thick.

The Fields Division :—

Several home-made devices are used for setting fire to fern and other dry surface growth, and have given satisfactory results. A piece of pumice soaked in kerosene, and to which is attached a handle made of wire, is simple and effective. The lighted pumice is dragged along through the fern. Another method consists of a piece of gas-pipe with a wick of waste; this is fed by kerosene from the pipe, the top end, held in the hand, being stopped up. In some districts a blow-lamp is favoured by settlers, and acts very efficiently.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Journal* from 14th July to 8th September, 1927, include the following of agricultural interest :—

No 55554. Wool-pack lining, M. A. Browne, Christchurch No 56292 Tractor-wheel travelling-band coupling, A. McDonald, Takapau No. 56337 Manure-distributor, C. Houchen, Hamilton No 56396. Sheep-shears: H Wiremu, Whangarei No 58282. Milk-sample collector, A. Illingworth, Alton No 58465: Retting of flax; J C W Stanley, Victoria, B.C. No 56884. Electro-culture machine, L. J. A. Trouchet (nominee of J. Christofleau), Perth, W.A. No 58558: Manure-sowing machine, C. W. U. Sorensen, Hamilton No. 55978 Automatic cow-feeder; T. E. Larking, Okato No 56033. Grain-drill lift; S. Upritchard, Arundel. No. 56140 Threshing-machine attachment G. E. Barnes, Darfield. No. 56540: Marker for manure-sowing machine, W. F. Griffin, Hatuma. No 56674. Teat-cup cleaner, C. Christie, Invercargill No. 57005 Cream-can float, J. L. Crane and others, Whangarei No 57183 Concrete fencing-post; R. H. Bird, Napier No 57316: Manure-sower, W. T. London, Tauranga. No 57215: Cow-tail holder, E. Ryan, Masterton. No 58476: Wire-strainer; T. McKenzie, Otaki. No 58866. Sheep-shearing machine J. Davidson, Sydney, N.S.W. No 57017 Milk-releaser, J. Taylor, Eltham No 57403: Manure broadcast distributor, E. Ryan, Masterton. No 57448. Milk-can; D. Robertson, Wellington No 57624: Rabbit-trap; H. S. Ringstad, Marrickville, N.S.W. No 58418. Casein-drying machine C. Hope-Johnstone and R. S. Smith, Auckland No. 58702. Sheep-shears, Chicago Flexible Shaft Co., Chicago, U.S.A. No 58820. Scutching-machine, Maddren Bros, Christchurch. No. 58956: Milking-machine rubber mouthpiece, C. P. Dmsen, Denmark

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office, or fees may be remitted by Post Office order or postal note.

AGRICULTURAL SHOWS, SEASON 1927-28.

THE following show-dates have been notified by agricultural and pastoral associations :—

Hawke's Bay A. and P. Society : Tomoana, 19th and 20th October, 1927.
 Poverty Bay A. and P. Association : Gisborne, 25th and 26th October.
 Wairarapa A. and P. Society : Carterton, 26th and 27th October.
 Timaru A. and P. Association : Timaru, 26th and 27th October.
 Manawatu A. and P. Association : Palmerston North, 1st, 2nd, and 3rd November.
 Kelso A. and P. Association : Kelso, 2nd November.
 Northern A. and P. Association : Rangiora, 4th November.
 Canterbury A. and P. Association : **Royal Show**, Christchurch, 9th, 10th, and 11th November.
 Waimate A. and P. Association : Waimate, 15th November.
 Egmont A. and P. Association : Hawera, 16th and 17th November.
 North Otago A. and P. Association : Oamaru, 17th and 18th November.
 Otago A. and P. Society : Dunedin, 23rd and 24th November.
 Stratford A. and P. Association : Stratford, 23rd and 24th November.
 Tokomairiro Farmers' Club : Milton, 28th November.
 Clutha and Matau A. and P. Society : Balclutha, 1st and 2nd December.
 Auckland Metropolitan A. and P. Association : Auckland, 2nd and 3rd December.
 Wyndham A. and P. Association : Wyndham, 9th December.
 Otago Peninsula A. and P. Society : 10th December.
 Nuhaka A. and P. Association : Nuhaka, 1st January, 1928.
 Marton District A. and P. Association : Marton, 18th January.
 Waipukurau A. and P. Association : Waipukurau, 20th January.
 Horowhenua A. and P. Association : Levin, 24th and 25th January.
 Tapanui Farmers' Club : Tapanui, 25th January.
 Rangitikei A. and P. Association : Taihape, 25th and 26th January.
 Golden Bay A. and P. Association : Motupipi, 1st February.
 Woodville A. and P. Association : Woodville, 3rd and 4th February.
 Clevedon A. and P. Association : Clevedon, 4th February.
 Feilding A. and P. Association : Feilding, 7th and 8th February.
 Dannevirke A. and P. Association : Dannevirke, 8th, 9th, and 10th February.
 Hikurangi-Otonga A. and P. Association : Hikurangi, 9th February.
 Masterton A. and P. Association : Solway, 14th and 15th February.
 Te Awamutu A. and P. Association : Te Awamutu, 15th February.
 Taumarunui A. and P. Association : Taumarunui, 15th February.
 Tauranga A. and P. Association : Tauranga, 22nd February.
 Ohura A. and P. Association : Matiere, 22nd and 23rd February.
 Franklin A. and P. Association : Pukekohe, 24th and 25th February.
 Hukerenui Agricultural Association : Hukerenui, 1st March.
 Mongonui County A. and P. Association : Kaitaia, 3rd March.
 Opotiki A. and P. Association : Opotiki, 6th March.
 Taranaki Agricultural Society : New Plymouth, 7th and 8th March.
 Matamata A. and P. Association : Matamata, 13th March.
 Kaikoura A. and P. Association : Kaikoura, 16th March.
 Mayfield A. and P. Association : Mayfield, 17th March.
 Hawarden A. and P. Association : Hawarden, 23rd March.
 Methven A. and P. Association : Methven, 29th March.
 Oxford A. and P. Association : Oxford, 5th April.

Subsidy for Destruction of Kea.—The subsidy of 5s. per beak paid by the Department of Agriculture for kea-destruction totalled £766 15s. for the official year 1926-27. This represented 3,067 birds, a decrease of 830 on the preceding year.

Water Content of Export Butter.—During the year ended 31st March last the Dairy Division tested 133,206 churnings. The average water content was 15.15 per cent., compared with 15.17 per cent. in 1925-26. The number of churnings found to be over the legal limit (16 per cent. of water) represented 0.694 per cent. of the total. These were returned to the respective factories to be reworked with drier butter.

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No. 4.

DAIRY-HERD TESTING IN NEW ZEALAND.

REVIEW OF 1926-27 SEASON.

W. M. SINGLETON, Director of the Dairy Division, Wellington.

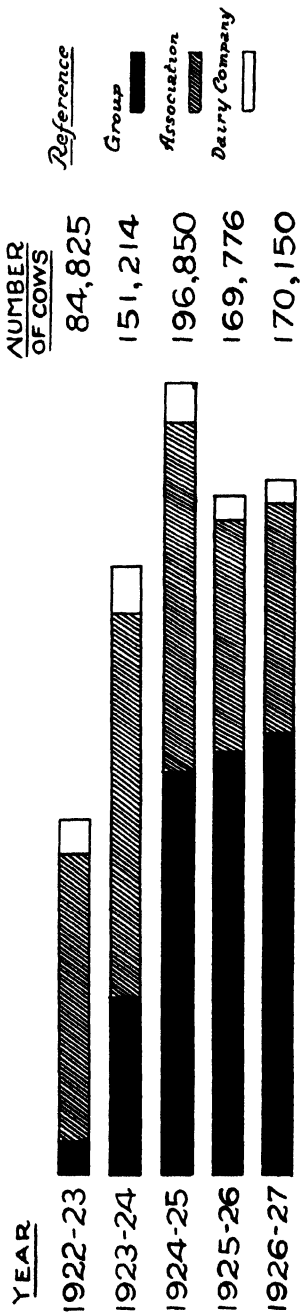
THE support accorded to dairy-herd testing in New Zealand during the season 1926-27 has been such as to result in a slight increase in the total number of cows tested compared with the preceding season. The increase is made of more importance when one takes into consideration the fact that the total number of cows in milk and dry in the Dominion decreased between 1925 and 1927 by some 28,000. For the purposes of this review a dairy cow is classed as a tested cow when she has been tested twice or more during the season. On this basis the number of cows under herd-test during 1926-27 stands at 170,150, as against 169,776 for 1925-26, an increase of 374 cows, or 0.2 per cent. The 170,150 tested animals represent 13 per cent. of the total of our dairy cows in milk and dry.

Considered under the headings of the three systems of herd-testing recognized in the Dominion, Group testing shows an increase of 4,600 cows, Association testing a decrease of 2,522, and Dairy Company testing a decrease of 1,704. Details of this classification for the past five seasons are supplied in Table 1. The accompanying graph, covering the same period, gives a clearer conception of the relative extent of the testing as a whole and according to system.

Table 2 presents an interesting subdivision, providing a classification of tested cows according to land districts, the last five seasons being included. The table would have been more interesting could we have shown separately, for comparison, the number of cows in milk and cows dry in each land district, but, unfortunately, these statistics for 1926-27 are not yet available. As the table shows, Auckland still leads in possessing the greatest number of tested cows. A gratifying feature is the much improved position of Canterbury. Despite a small increase this year, Otago's position is still very disappointing; it is also regrettable that Southland did not maintain the comparatively high standard reached last season. It will be observed that the total number of tested cows in the North Island decreased by 753, while the South Island showed an increase of 1,127.

Table 1.—Number of Cows tested Twice or more classified according to Season and System of Testing.

System.	1922-23.			1923-24.			1924-25.			1925-26.			1926-27.		
	Associa- tions, &c.	Cows.	Average Cows per Associa- tion, &c.	Associa- tions, &c.	Cows.	Average Cows per Associa- tion, &c.	Associa- tions, &c.	Cows.	Average Cows per Associa- tion, &c.	Associa- tions, &c.	Cows.	Average Cows per Associa- tion, &c.	Associa- tions, &c.	Cows.	Average Cows per Associa- tion, &c.
Association ..	90	67,835	754	114	96,198	844	117	87,695	750	124	59,345	479	116	56,823	489
Group ..	6	7,500	1,250	34	43,144	1,269	91	100,955	1,100	86	105,227	1,224	96	109,827	1,144
Dairy Company	46	9,490	206	42	11,872	283	51	9,100	178	38	5,204	137	28	3,500	125
All ..	142	84,825	597	190	151,214	796	259	196,850	760	248	169,776	685	240	170,150	709



GRAPH SHOWING THE EXTENT OF HERD-TESTING IN NEW ZEALAND FOR LAST FIVE YEARS—AS A WHOLE AND ACCORDING TO SYSTEM.

Table 2.—Number of Cows tested twice or more, classified according to Season and Land District, &c.

Land District, &c.	Cows tested twice or more.				
	1922-23	1923-24	1924-25	1925-26	1926-27
North Auckland ..	17,973	23,521	31,049	24,951	24,610
Auckland ..	32,123	63,945	93,912	77,651	82,338
Gisborne ..	2,410	3,122	4,022	3,891	2,626
Hawke's Bay ..	1,620	4,301	5,468	4,902	2,987
Taranaki ..	15,585	18,567	16,840	16,485	14,696
Wellington ..	12,062	30,584	37,415	29,653	29,517
North Island ..	82,601	144,130	188,766	157,533	156,780
Nelson ..	.	1,192	574	880	620
Marlborough ..	105	175	147	441	258
Westland ..	.	771	.	.	74
Canterbury ..	1,400	2,345	2,171	1,799	4,292
Otago ..	400	2,416	1,859	903	950
Southland ..	130	185	3,393	8,220	7,176
South Island ..	2,131	7,084	8,144	12,243	13,370
Common ..	84,825	151,214	196,850	169,776	170,150

Table 3 gives the numbers of cows, herds, and associations, together with the average size of herds and associations, represented in all effective annual summaries (on the 100-days-or-more basis) received for the past three seasons. The term "association" as used in this table denotes a herd-testing organization, whether Group, Association, or Dairy Company. As pointed out in a previous review, there is, unfortunately, a confusion in herd-testing nomenclature, inasmuch as organizations operating under either the Group or the Association system are termed "herd-testing associations," or simply "associations."

Table 3.—Number of Cows, Herds, and Associations* represented in Effective Seasons' Summaries received (Basis: All Cows in Milk 100 Days or over)

	1924-25	1925-26	1926-27
Number of associations ..	100	201	211
Number of herds ..	4,815	4,458	4,978
Number of cows ..	151,875	116,398	155,928
Average number of herds per association ..	25	22	22
Average number of cows per herd ..	32	33	33
Average number of cows per association ..	790	728	734

* Including both Group and Association systems, and on basis of sections or units.

Table 4 supplies a classification of groups and associations according to herds and cows. It will be noted that the associations have a tendency to grow smaller, whereas the groups remain more uniform.

Table 4.—Average Size of Associations and Groups for which Effective Seasons' Summaries on the Basis of all Cows in Milk 100 Days or over were received.

System	Season.	Average Number of Herds per Association or Group.	Average Number of Cows per Association or Group.	Average Number of Cows per Herd.
Association	1924-25	25	574	23
	1925-26	19	497	22
	1926-27	18	408	22
Group	1924-25	26	1,185	45
	1925-26	27	1,205	44
	1926-27	26	1,127	43

In the groups the herds are about twice as large as in the associations, possibly mainly because the Group testing rules insist upon the inclusion of all sound cows, whereas the Association system often represents a selection. This does not necessarily mean a selection of the better cows in the herd, but that often only cows previously untested are offered, or cows which the owner specially desires tested. There is also the influencing factor that group testing can be operated most economically in districts where the herds are large.

AVERAGE YIELD OF TESTED COWS.

Effective summaries received for the 1926-27 season represent 91.1 per cent. of the total number of cows tested twice or more for all groups and associations. Opportunity is here taken to record our appreciation of the prompt and accurate manner in which the various herd-testing officers have complied with the request for summaries of results. Every person communicated with responded, and, as will have been noted, in less than 9 per cent. of the cases were the summaries incomplete or obviously unreliable. Production summaries are requested on the basis of all cows in milk 100 days and over, and the numbers so represented in the effective summaries received for the past season total 155,028 cows, as against 146,398 for the preceding season.

Table 5 is a grand summary of production results for the past two seasons. The most conspicuous feature of this table is the increase of some 20 lb. of butterfat in the production of the average tested cow. This is certainly a material improvement. Although doubtless an exceptionally favourable season accounted for much of the increase, it is equally certain that due credit should be given to the influence of herd-improvement.

Table 6 supplies a comparison of average production according to system of operation. It will be noticed that the yield of the average cow on Association test has improved by some 17 lb. of butterfat, while the Group average has increased by almost 21 lb. It will also be observed that the average days in milk increased by three for Association test, and by five for the Group method.

In Table 7 have been collected production results under the headings of cows in milk 100 days or more, and cows in milk 210 days or

Table 5.—Grand Summary of all Effective Herd-testing Results on the Basis of all Cows in Milk 100 Days or over received for the Last Two Seasons.

	1925-26.		1926-27.	
	Days in Milk.	Butterfat-production.	Days in Milk.	Butterfat-production.
		lb.		lb.
Average for all cows (140,398 in 1925-26 and 155,028 in 1926-27)	230	220.51	236	240.48
Highest Association or Group average ..	263	323.24	240	357.46
Lowest Association or Group average ..	168	153.14	131	94.88
Highest herd average	233	500.21	317	511.91
Lowest herd average	125	51.69	100	65.13
Highest cow	286	819.85	276	795.09
Lowest cow	120	11.13	103	17.44
Average daily production of butterfat for all cows	..	0.96	..	1.02

Table 6.—Average Production of all Effective Results for Past Two Seasons classified according to System. (Basis: All Cows in Milk 100 Days or over.)

Season.	System.	Number of Associations or Groups.	Number of Herds.	Number of Cows.	Average Days in Milk.	Average Butterfat.
						lb.
1925-26 ..	Association ..	120	2,239	48,823	217	215.40
	Group ..	81	2,219	97,575	236	223.06
1926-27 ..	Association ..	115	2,140	46,878	220	232.64
	Group ..	96	2,538	108,150	241	243.88

Table 7.—Average Production for Associations conducted by Officers of the Dairy Division, comparing Difference in Production between Results of Summaries compiled on the Basis of all Cows in Milk 100 Days or more and 210 Days or more.

Year.			100 Days or more.		210 Days or more.	
			Average Days.	Average Butterfat.	Average Days.	Average Butterfat.
				lb.		lb.
1922-23 .. ..	..	..	227	232.99	261	271.48
1923-24 .. ..	..	..	227	221.39	258	267.10
1924-25 .. ..	..	..	223	231.51	258	266.29
1925-26 .. ..	..	..	218	221.19	257	259.20
1926-27 .. ..	..	..	236	247.35	262	273.36

more. These figures are based on results from associations tested by Dairy Division officers, similar information for cows tested in privately-controlled organizations not being available. This type of summary has certain advantages, inasmuch as it provides an indication of production over a period more in conformity with that of the length of a dairying season. The 100-days-or-more summary has the advantage that it includes records for some cows of such poor quality that

Table 8.—Average Production, according to Land Districts, &c., of all Cows under Herd-test for which Effective Seasons' Summaries were obtained (Basis: All Cows in Milk 100 Days or over.)

Land District, &c.	1923-24.				1924-25.				1925-26.				1926-27.			
	Cows in Summary.	Average Days in Milk.	Average Butterfat.	lb.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	lb.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	lb.	Cows in Summary.	Average Days in Milk.	Average Butterfat.	lb.
North Auckland ..	.. 16,270	219	200.23	25,685	216	205.14	20,925	224	210.94	21,471	224	232.46	21,471	224	232.46	232.46
Auckland ..	.. 48,253	234	207.86	77,003	235	224.98	73,101	236	226.08	78,625	240	244.82	78,625	240	244.82	244.82
Gisborne ..	.. 2,026	209	202.16	3,455	204	208.34	3,368	212	191.03	2,405	217	218.08	2,405	217	218.08	218.08
Hawke's Bay ..	.. 1,790	231	228.34	4,575	243	233.25	4,204	224	189.32	2,285	230	208.95	2,285	230	208.95	208.95
Taranaki ..	.. 13,377	233	246.66	11,683	233	251.58	12,846	235	242.42	12,857	241	239.67	12,857	241	239.67	239.67
Wellington ..	.. 22,402	237	215.60	24,199	228	230.99	22,043	223	212.64	25,400	258	250.53	25,400	258	250.53	250.53
North Island ..	.. 104,118	232	213.56	146,600	230	224.48	136,577	231	221.11	143,043	240	232.29	143,043	240	232.29	232.29
Nelson ..	.. 235	195	204.93	104	258	283.16	600	192	207.16	261	233	239.27	261	233	239.27	239.27
Marlborough ..	.. ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Westland ..	.. ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Canterbury ..	.. 1,483	191	199.76	909	196	213.15	391	195	217.21	3,917	207	219.03	3,917	207	219.03	219.03
Otago ..	.. 1,819	196	193.73	1,249	204	203.04	804	218	223.60	820	199	247.02	820	199	247.02	247.02
Southland ..	.. 122	204	210.91	3,013	191	187.28	8,017	217	211.14	6,987	217	215.36	6,987	217	215.36	215.36
South Island ..	.. 3,659	194	197.47	5,275	197	197.36	9,821	214	212.15	11,985	213	219.06	11,985	213	219.06	219.06
Dominion ..	.. 107,777	230	213.01	151,875	229	223.54	146,398	230	220.51	155,028	238	241.66	155,028	238	241.66	241.66

Table 9.—*Distribution of Records for all Tested Cows in the Dominion represented in Effective Annual Summaries received, Seasons 1925-26 and 1926-27. (Basis : In Milk 100 Days or over.)*

System.	Class Limits (in Pounds of Butterfat).																Total Number of Cows classified.	
	Under 50.	50-100.	100-150.	150-200.	200-250.	250-300.	300-350.	350-400.	400-450.	450-500.	500-550.	550-600.	600-650.	650-700.	700-750.	750-800.		800-850.
1925-26.																		
Numbers																		
Association Group	122	2,207	7,853	11,351	11,488	8,211	4,293	1,745	582	163	46	9	2	..	..	..	1	48,073
..	285	3,610	12,133	22,886	25,738	18,306	9,565	3,620	1,067	282	55	11	11	4	1	1	..	97,575
Both	407	5,817	19,986	34,237	37,226	26,517	13,858	5,365	1,649	445	101	20	13	4	1	1	1	145,648
Percentages																		
Association Group	0.25	4.59	16.34	23.61	23.90	17.08	8.93	3.63	1.21	0.34	0.10	0.02	*	..	..	..	*	48,073
..	0.29	3.70	12.43	23.45	26.38	18.76	9.80	3.71	1.09	0.29	0.06	0.01	0.01	*	*	*	..	97,575
Both	0.28	3.99	13.72	23.51	25.56	18.21	9.51	3.68	1.13	0.31	0.07	0.01	0.01	*	*	*	*	145,648
1926-27.																		
Numbers.																		
Association Group	42	1,653	6,090	9,441	10,855	8,903	5,545	2,663	954	289	75	23	7	2	..	..	..	46,542
..	89	2,251	8,946	19,098	26,396	23,644	15,035	7,010	2,603	799	203	47	9	4	..	2	..	106,136
Both	131	3,904	15,036	28,539	37,251	32,547	20,580	9,673	3,557	1,088	278	70	16	6	..	2	..	152,678
Percentages.																		
Association Group	0.09	3.55	13.08	20.28	23.32	10.12	11.91	5.72	2.04	0.62	0.16	0.04	0.01	*	..	..	..	46,542
..	0.08	2.12	8.42	17.99	24.86	22.27	14.16	6.60	2.45	0.75	0.19	0.04	*	*	..	*	..	106,136
Both	0.08	2.55	9.84	18.69	24.39	21.31	13.47	6.33	2.32	0.71	0.18	0.04	0.01	*	..	*	..	152,678

* Data occurring, but relatively insignificant.

their lactation periods fall short of 210 days. On the other hand, it has the disadvantage of including certain cows which should perhaps be omitted—cows that have died, fallen sick, been sold, or for some other reason have been discontinued some time before their testing would have been completed.

Table 8 enables those interested to compare average production by land districts. It will be noticed that in every instance except one there has been an increase in average production, the exception being Taranaki.

In studying these production tables readers must not overlook the fact that they represent the yield of tested cows, and not of all cows in New Zealand, and thus show our dairy cow in the most favourable light. As a general rule, though, needless to say, not without many exceptions, only the better herds are tested; and even in the tested herds many of the poorer cows are retained for only a short period after the season's testing commences. While for 1926-27 the average tested cow in New Zealand produced 241.66 lb. of butterfat, the average dairy cow, comprising all cows in milk and dry, yielded only some 200 lb.

Table 9 supplies an analysis of individual records, and is useful for indicating just how many cows may be considered profitable and how many unprofitable. Similar figures for 1925-26 are included for purposes of comparison. As might be expected, the tables agree in respect that the greatest number of records fall within the 200-250 lb. butterfat division. It is pleasing to note, however, the considerably decreased percentage of cows in the first four subdivisions, and particularly in the three lowest grades.

THE FUTURE.

Herd-testing, like many other enterprises, has suffered from prevailing economic stringency. But herd-testing is too well established and too essential to lapse for a protracted period. There are indications that it is again on the upward trend, and we may anticipate that future years will witness the testing of a steadily increasing proportion of our dairy cows. The recently approved State financial assistance of £8,000, to be expended during the current season, will doubtless do much to assist in promoting herd-testing, and should afford practical relief to many farmers who are finding the fees a difficulty.

Lice-infested Sheep.—The Director of the Live-stock Division remarks in his annual report for 1926-27 as follows: Sheep affected with lice are still too numerous, and far too many prosecutions for exposing lice-infested sheep at saleyards have had to be taken. Notwithstanding these the position has not improved, and it would seem that if it is to be remedied more drastic action is required. It was pointed out in my last report that the Inspector has the power to order the withdrawal of lice-infested sheep from sale, and with the view to stopping the practice in question it is proposed that all Inspectors be instructed to see that such sheep are withdrawn. It does not follow, however, that when this action is taken it will relieve the owner of the sheep from prosecution.

PARASITIC CONTROL OF SHEEP MAGGOT-FLIES.

ESTABLISHMENT OF *ALYSIA MANDUCATOR* IN NEW ZEALAND.

DAVID MILLER, Entomologist, Biological Laboratory, Wellington.

THE work of establishing the blow-fly parasite *Alysia manducator* in New Zealand has made definite progress since publication of an introductory note on the subject in this *Journal* for January last.

Three consignments of parasitized blow-fly puparia were received from the Imperial Bureau of Entomology, London, during November, 1926, and in early and late January, 1927, respectively. The first and third consignments were sent by parcels-post, and the second in cool storage on board ship. The puparia were packed in damp moss in wooden boxes wrapped with waxed paper.

On arrival of the first consignment, consisting of 1,150 puparia, the adults of *Alysia* were emerging and very active: a total of 102 parasites was secured from this consignment. When opened, the *Alysia* in the second consignment, though carried in cool storage, had commenced to emerge, but were not very active: this consignment contained 1,700 puparia, but only 50 *Alysia* in all were secured from it. In the third consignment the conditions of moisture were excessive, so that a considerable proportion of the puparia had become flattened and damaged. Though this was the largest consignment, containing 2,200 puparia, a total of only 80 *Alysia* was secured.

From these consignments, therefore, a total of 232 *Alysia* developed, of which 60 per cent. were females. As the *Alysia* emerged they were placed in cages containing maggots, which they immediately attacked. Large supplies of maggots were kept available by exposing liver to the different species of blow-flies. It was found that of the latter the maggots of the golden-haired blow-fly (*Calliphora stygia*), the European bluebottle (*C. erythrocephala*), the European greenbottle (*Lucilia sericata*), and the Australian greenbottle (*Chrysomya rufifacies*) were readily parasitized, and in them *Alysia* carried through to the next generation. This is of considerable importance, since *C. stygia*, *L. sericata*, and *C. rufifacies* are the species damaging sheep in New Zealand.

It is also noteworthy that attempts to parasitize the small native bluebottle (*Calliphora icela*) have so far failed, *Alysia* not even attempting to oviposit in the maggots. This is in keeping with the results secured when maggots of all the species mentioned were exposed in the one cage to *Alysia*. Among the blow-flies emerging on that occasion were numerous *icela* and very few of the other species, while sufficient *Alysia* were secured for field distribution. It was found that the cycle of *Alysia* from egg to adult varies from six to eight weeks.

The first New-Zealand-reared generation of *Alysia* commenced to emerge on 3rd January, 1927, and from then until April generations were periodically secured. Field liberations were made from January to March as follows:—

First: 5th January, at "Avondale," Blenheim.

Second: 11th January, at Mount Somers, Canterbury.

Third : 5th February, at "Avondale."

Fourth : 7th March, at "Avondale."

Fifth : 14th March, at "Avondale."

Sixth : 14th April, at Weraroa.

Seventh : 25th April, at Kaitaia, North Auckland.

The liberations were made on maggot-infested carcasses under natural conditions in the field. Mr. C. G. Teschemaker, of "Avondale," on being notified some days beforehand that a consignment of *Alysia* was being sent, had a sheep killed on each occasion and well infested with developed maggots at the time the parasites arrived. At Weraroa the *Alysia* were liberated on an accumulation of maggot-infested offal, while the Kaitaia liberation was made on an ox-carcass infested mainly with larvæ of the Australian greenbottle.

That *Alysia* successfully passes the winter in New Zealand is certain, at least in the insectaries, where on 20th September this year the first of the spring generation emerged from infested puparia. The numbers of this first emergence reached a maximum on 30th September, but to date (6th October) have fallen off considerably. What is happening in the field is not yet known; there are several factors to which *Alysia* will be exposed under natural conditions that might seriously hamper its development. One such factor is the presence of other parasites. Among these is *Mormoniella* (*Nasonia*) *brevicornis*, which, according to Dr. G. A. K. Marshall, interferes with *Alysia* in England; another parasite is a braconid (*Phaenocarpa* sp.), identified by the Imperial Bureau of Entomology, which in New Zealand parasitizes the golden-haired blow-fly in the same way as does *Alysia*.



BLOW-FLY EGGS, MAGNIFIED.

[Photo by H. Drake.]

DAIRY-FARMING ECONOMICS.

(Continued.)

SURVEY OF A RAGLAN COUNTY FARM GROUP, SEASON 1926-27.

E. J. FAWCETT, M.A., Fields Division, Wellington

Introductory Notes on the Raglan District.

THE greater portion of the district under review was taken up from the Government in the "sixties." At that time a considerable portion was covered with bracken fern, with manuka on the drier knolls. When the bracken was burnt off preparatory to cultivation logs were exposed, so that originally this country had evidently been under forest. The bush is principally heavy rimu, totara, tawa, and tanekaha, while the moister flats support good stands of kahikatea even at the present time.

Wheat was the main crop of the earlier settlers, this being put in with the spade, and shiploads of wheat were sent to Auckland and to Australia. Much of the land was virtually cropped out at that time. Cattle-raising soon followed, and before many years sheep flocks were general. Last year's returns gave the number of sheep in Raglan County as 268,000, with an average clip of 8½ lb wool. Raglan is therefore the leading sheep-farming county in the Auckland Land District, and has the further distinction of carrying 502 sheep per 1,000 acres, a figure far in excess of any other Auckland county.

The dairy industry commenced in 1902 with the opening of a small factory at Te Mata by Mr. W. J. Smith. In 1905 the Raglan Co-operative Dairy Co. erected its first factory at Kauroa. In 1911 the establishment was removed to Raglan, and this factory at the present time takes the bulk of the cream produced in the locality.

There is no great variation of soils. For the most part the land is gently rolling to steep, and the soils heavy red volcanic clays residual from the basaltic and andesitic rocks which form the Karioi Mountain. Limestone outcrops appear at various points, as do also conglomerate volcanic rocks and sandstones. Most of the clay soils are heavy, retentive, and sticky when sodden, likewise they tend to dry out in the summer and under the influence of winds. The pastures are noticeable for their dense green colour, and clover-growth is very strong. Good crops of swedes, rape, and maize are grown, and early crops of hay and ensilage can be harvested.

Gorse and blackberry were introduced in the "seventies," and have spread very considerably. At the present time hundreds of acres are covered with giant gorse. The method of dealing with this weed is to cut and burn, plough, and crop with swedes. A second crop of soft turnips or rape is usually taken off, and the land made ready for grassing in the autumn. Various modifications of this system are practised, but usually gorse land receives three ploughings before being permanently grassed. Scattered gorse in pasture land is grubbed out and burnt.

Very little top-dressing of pastures was practised before 1914. Up till then the inward shipments of fertilizers at the Port of Raglan amounted to some 300 to 400 tons annually, most of which was used on the swede crop. In 1920 the quantity had increased to 787 tons, and in 1926 to 1,357 tons, this indicating the growth of the dairy industry. During the last two years considerable quantities of manure have been sent in from Hamilton as back-loading on the lorries which collect cream that is supplied to the Waikato dairy companies.

In 1921 the outward shipments of butter amounted to 91 tons, and in 1926-27 this had increased to 263 tons. From 1925 a larger quantity of cream has been sent out to the Waikato.

Dairying may be said to be still in its youth in this locality. Herd-testing has not come fully into vogue; therefore there has been little culling of unprofitable cows, and no guide as to what calves should be saved for replacements. Last season, however, a commencement in systematic herd-testing was made. With

its inception, the added use of phosphatic manures, and the more scientific management of grasslands, dairy farms here should soon compare with any others in the Auckland District. Basic manures are generally advisable for the stiff clay soils that comprise the greater portion of the area under review.

The average rainfall of 55.58 in. per annum is evenly distributed, thus favouring the dairy industry. The monthly average precipitation is as follows: January, 3.70 in.; February, 3.30; March, 3.20; April, 4.57; May, 4.94; June, 6.53; July, 6.19; August, 4.69; September, 3.66; October, 5.59; November, 3.87; December, 4.34. For the year ended December, 1926, the fall was 57.64 in. Moderate sea-breezes are experienced throughout the year, and hard frosts are exceptional.

Raglan Township is distant thirty miles from Hamilton by a good metalled road, which has been gazetted a main highway. The highest point on this road is 650 ft. above sea-level. The Northern Steamship Co. runs a weekly service with the Port of Onehunga. The output of the Raglan Dairy Co. is shipped to Onehunga, and most freight is brought in by sea. Cattle and sheep, on the other hand, find their markets in the Waikato.

—G. W. Wild, B.Ag., *Instructor in Agriculture, Auckland.*

General Description of Farm Group.

The group to which this survey pertains is comprised of twenty-six farms, sixteen of which are entirely devoted to dairying, while on ten mixed dairy and sheep farming is practised. As indicated by Mr. Wild in his introductory notes, the district is in a state of active development. Very rapid improvement, however, cannot be expected, owing to the limited earning-capacity of the land, coupled with restricted financial resources.

On those farms devoted to dairying 68 per cent. of the land is in use, but even of this a certain proportion provides only feed for wintering or for dry stock. Where sheep are carried in addition to cows 88 per cent. of the land is being used, although much of it is partially occupied by fern and manuka. It would appear that an additional 20 per cent. of the area on the dairy farms could be used for sheep without affecting butterfat-production. The average area of the dairy farms is 173.8 acres, ranging from 60 to 370 acres, while that of the mixed farms is 387.1 acres, ranging from 84 to 792 acres. Root crops are grown in most cases on the first furrow preparatory to putting new land into grass. The area cut for hay per 100 acres is 9.3 and 7.4 acres respectively. Herd replacement is lower in this district than is the case on the high-producing Waikato plains, the average for all farms in the group being 12.61 per cent. The carrying-capacity of the whole group is practically the same if reduced to sheep capacity on the basis of seven sheep equalling one cow. All the farms supply butter-factories.

Table 1.—Miscellaneous Data per 100 Acres.

	Root Crops.	Hay or Ensilage.	Herd Replacement.	Sheep-carrying Capacity (1 Cow = 7 Sheep).	Area in Use.	Cows per 100 Acres on Cleared Area.	Butterfat-production per 100 Acres cleared.
	Acres.	Acres.	Per Cent.		Acres.		lb.
Dairy farms ..	7.562	9.312	13.22	158.375	68	33.272	6,430.206
Mixed farms ..	7.900	7.400	11.72	157.860	88	..	..

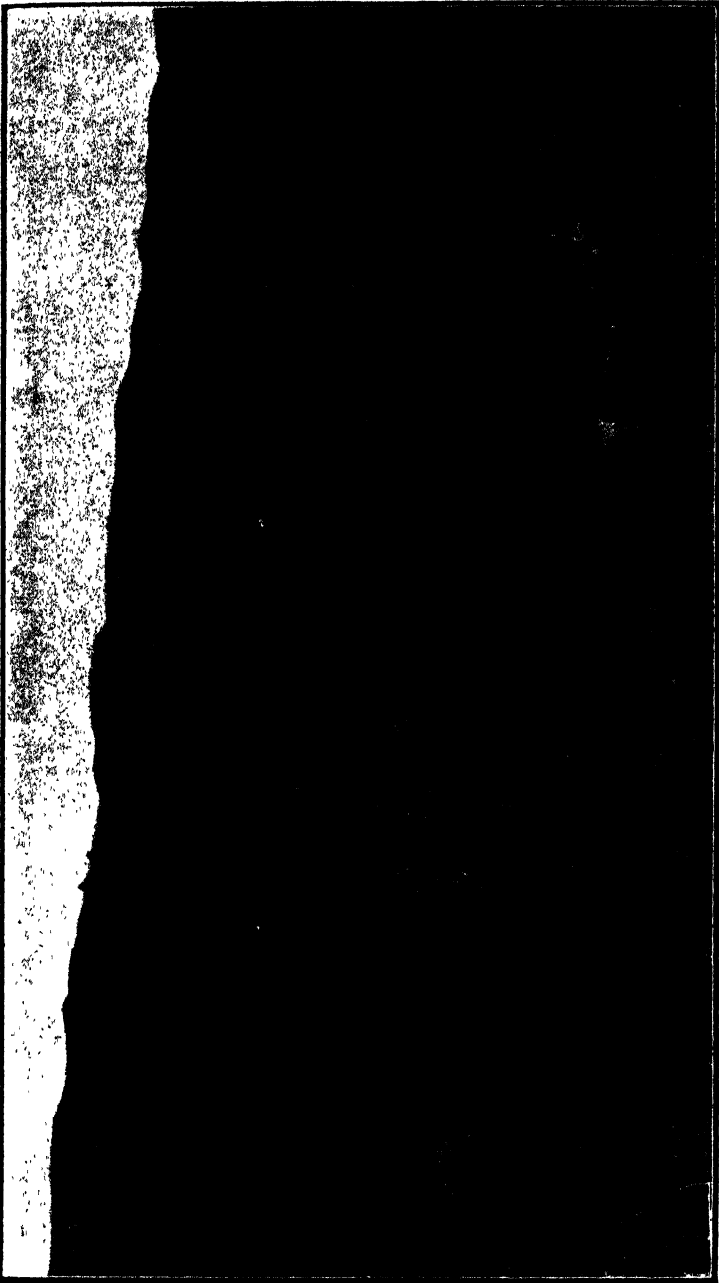


FIG. 1. TYPICAL COUNTRY IN RAGLAN DISTRICT

The large proportion of non-producing land on the farms may be seen from this and some of the accompanying photos.

[Photo by H. Drake.

Labour employed.

The major farming operations are performed by the family, outside help being but rarely employed on milking, but rather on improvement works. Table 2 shows the amount of labour employed and the "wage capacity" per 100 acres for each unit. Wage capacity represents the surplus after all expenses have been met and interest at 7 per cent. on personal capital deducted. Shearing, crutching, &c., have been charged direct to Sheep Account, and do not appear in this summary.

Table 2—Family per 100 Acres, and Number employed.

	1.	2.	3.	4.	5.	6.
	Total Family	Hired Labour (Permanent).	Children helping.	Family Adults working.	Total Units of Labour.	Wage Capacity per Unit.
						£ s d.
Dairy farms ..	2 555	0·144	0·283	0·807	1·237	68 7 3
Mixed farms ..	1·292	0·130	0·335	0·335	0·800	66 2 0

Production and Expenses per 100 Acres.

Tables 3 and 4 show carrying-capacity, production, and costs per 100 acres on dairy and mixed farms respectively.* Dairy farms have been subgrouped in fours from the highest to the lowest production of butterfat per acre, the figures given representing the averages for each subgroup of four farms. To allow of comparison with the figures of the Piako County group published in the August *Journal*, butterfat has been valued at 1s. 4d. per pound, interest on all capital charged at 6 per cent. plus 1 per cent. sinking fund, and labour at £7 per cow.

Table 4 pertains to ten mixed farms divided into two groups of five farms each. In this case labour cannot be considered on a per-cow basis, but is shown as wage capacity per 100 acres only.

Analysis of Dairy-farm Figures.

The position of these farms is summarized in Table 3. It should be noted that column No. 1 gives the actual average area of the farms within each subgroup. As the size of farms increases, production per acre decreases, indicating the superiority of small areas of this class of country when devoted entirely to dairying. Carrying-capacity is considerably higher, resulting in a higher per-acre production. The proportion of unused land is smaller, and allows of more concentrated effort on improvement. The drawback of small areas, however, is that the wage capacity is barely sufficient to maintain a family, improvements therefore depending on the labour of the owner rather than on a capital or revenue expenditure.

Carrying-capacity.

The number of cows milked per 100 acres varies from 35 to as low as 11·3, or from 2·85 to 8·85 acres per cow, with an average of 4·44

Table 3.—Position of Dairy Farms per 100 Acres.

(Four subgroups of four farms each; averages on basis of Government valuation; interest at 6 per cent., plus 1 per cent. sinking fund; wages, £7 per cow.)

Subgroup.	True Area.																			
	1.	2.	3.		4.		5.		6.		7.		8.	9.	10.	11.	12.	13.	14.	
		Cows milked.	Total Butterfat.	Butterfat per Cow.	Butterfat at But. 1d. per Pound.	Pigs.	Cattle.	Total	Capital Value of Land, Stock, and Plant.	Interest.	Labour.	Expenses.	Total.	Profit.	Loss.	Production Costs per Pound of Butterfat.	Wage Capacity.	Wages per Cow.	Manure for Top-dressing.	Manure per Cow.
Acres.			lb.	lb.	f		f	f	f	f	f	f	f	f	f	d.	f	f	Tons.	Cwt.
..	84.8	33,625	642,005	190,990	428	50,250	43,000	524,750	3592 5	175	235	188,250	598,250	..	73,500	22.4	161,500	4,802	13,590	8,419
..	146.5	22,150	472,595	213,270	315	30,750	19,000	377,250	1875 5	131	155	134,250	420,250	..	43,000	21.4	112,000	5,056	7,933	5,056
..	207.0	20,850	395,010	189,450	263	22,500	3,500	292,500	1715 0	120	146	116,750	382,750	..	90,250	23.3	55,750	2,674	8,073	8,073
..	256.8	13,875	239,005	172,544	160	10,750	16,500	187,250	1225 0	86	97	92,250	275,250	..	88,000	27.6	9,000	0,649	7,430	10,739
General average	173.8	22,625	437,554	193,261	291	28,563	20,500	345,437	1830 0	128	158	132,875	418,875	..	73,438	23.2	84,562	3,737	9,563	8,454

* Losses experienced in these subgroups.

Table 4.—Position of Mixed Sheep and Dairy Farms per 100 Acres.

(Two subgroups of five farms each; averages on basis of Government valuation; interest at 6 per cent. plus 1 per cent. sinking fund)

Subgroup.	1. True Area.	2. Cows milked.	3. Butterfat.	4. Sheep wintered.	5. Returns from	6. Capital Value of Land, Stock, and Plant.	7. Expenses.	8. Wage Capacity.	9. Manure used.
	Acres.	lb.	lb.	Per Cow.	Pigs	Cattle.	Sheep.	Total.	Upkeep and Running.
1	286.8	15,64	270,454	172,925	51 0	180	36.4	252 0	116
2	487.4	6,52	148,58	227,385	109 2	98	66.2	213 8	83
General average	387 1	11.08	209,516	188,949	80.1	139	50.3	232.9	99

* Losses experienced in these subgroups.

acres per cow. On comparatively low carrying and producing land, such as that of the Raglan district, it is probably easier to increase stocking than is the case on the heavily-stocked high-producing Waikato plains; but unless per-cow production is increased, a corresponding increase in cows does not result in a relatively high per-acre production increase.

Butterfat-production.

The per-acre production capacity of this land under existing conditions is low, ranging from 74.9 lb. to 15.03 lb. butterfat, with an average of 43.72 lb. It must be remembered that approximately 32 per cent. of the land is not used, and that the butterfat-production standard of cleared land is 64.3 lb. per acre. It is not at present possible to estimate correctly the average per-acre production for the whole of the dairying-land of New Zealand, but if 200 lb. be accepted as the average production per cow, then the per-acre production must be between 50 lb. and 65 lb. This would indicate that the average for the group under review is comparable with that of the mass of farms below the New Zealand average.

Low per-acre carrying-capacity of herds with an average production ranging from 254 lb. to 133 lb. butterfat, with a general average of 193 lb., is a very difficult combination, which can only be rectified slowly while floating capital remains limited. Should carrying-capacity be increased, an additional five cows per 100 acres results in an increase of 9.65 lb. butterfat per acre; whereas with a per-cow production of 291 lb. (average for the Piako group) a corresponding increase of cows improves the per-acre production by 14.55 lb.

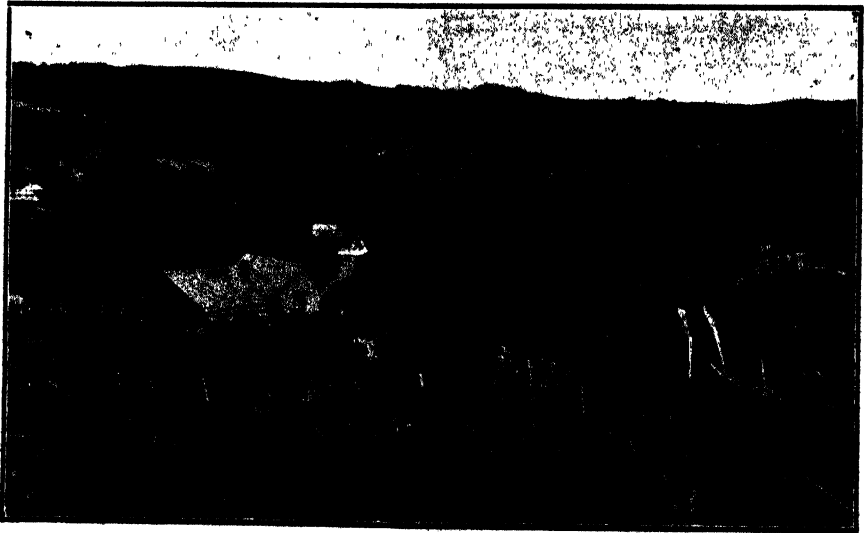


FIG. 2. ONE OF THE SMALL CENTRES IN THE DISTRICT.

The prevalence of gorse is shown by this view.

[Photo by H. Drake.

Returns per 100 Acres.

The average return from butterfat at 1s. 4d. per pound is £219, or £12 17s. 3d. per cow. Pigs are kept on fourteen of the farms, giving an average return of £1 5s. 3d. per cow. They were disposed of equally as porkers, baconers, or weaners, at the rate of 1.66 pigs per cow. Purchased foodstuff has been debited direct to the Pig Account. The Cattle Account resulted in a loss on five farms, but gave an average profit of £20 10s. per 100 acres over all. This is again accounted for to some extent by the appreciation in value of young stock drafted into the herd, and does not represent all cash.

The total returns thus amount to £345.437, or £15 5s. 4d. per cow, which represents £3 9s. 1d. per acre. The variation is from £6 12s. 2d. to £1 2s. 5d. per acre.

Capital Value.

Owing to the absence of a Land and Improvement Account, the Government valuation has been taken, and to this added the value of stock and plant. Stock values are kept uniform throughout. The position is set out in Table 5.

Table 5.—Capital per 100 Acres (Land at Government Valuation).

	1. Total Capital.	2. Land.		3. Stock.		4. Plant.	
		Value.	Percentage of Total.	Value.	Percentage of Total.	Value.	Percentage of Total.
Dairy farms ..	£ 1830	£ 1316	71.91	£ 331	18.08	£ 183	10.00
Mixed farms ..	1420	1091	76.83	245	17.25	84	5.91

The total capital of £1,830 is equivalent to £80 17s. 6d. per cow, of which 71.91 per cent. is land, 18.08 per cent. stock, and 10 per cent. plant. The range of capital is from £3,360 to £880 per 100 acres.

Upkeep and Running Expenses.

The cost of upkeep and running expenses amounts to £1 6s. 6d. per acre, or £5 17s. 6d. per cow, and is equivalent to 7.29d. per pound of butterfat. The range is from £2 8s. 2d. to 10s. 7d. per acre, the higher

Table 6.—Expenditure on Dairy Farms per 100 Acres.

(£132.875 = 100 per cent.)

Item.	Percentage of Total.
Fertilizers for top-dressing	44.333
Cartage of butterfat	10.667
County rates	8.333
Depreciation on plant and buildings..	8.333
Cultivation	7.167
Repairs to plant, fences, and buildings	7.167
Power (benzine)	6.083
Testing	4.500
Sundry	3.417
Total	100.000

cost being on higher-producing country. Certain items charged on a fixed rate, such as cartage of butterfat, testing, and power, influence the per-acre charge considerably. Of the costs itemized in Table 6, it will be seen that fertilizers for top-dressing pastures is the outstanding expense, representing 44·333 per cent. of the whole. Cartage of butterfat is charged at a fixed rate. This item is not paid directly by the farmers, being a deduction made by the dairy company concerned.

Total Expenses.

Total expenses have been computed on the basis of 6 per cent. interest on total capital value plus 1 per cent. sinking fund, and on a labour charge of £7 per cow plus upkeep and running costs. Such a standard is not unduly high, and it should be at least the aim of the dairying industry to breed and feed cows of a calibre able to support it. The expenses on this basis range from £641 to £194 per 100 acres, with an average of £418 17s. 6d., or £18 15s. 5d. per cow.

With wages charged on a per-cow basis, an increase in carrying-capacity influences the total cost considerably. Higher carrying-capacity is also reflected in higher interest charges on capital employed. These farms, however, will not support such a scale of expenses, but result in an average loss of £73 8s. 7d., or £3 5s. per cow. The wage capacity for the year under the present system of management is therefore £3 15s. per cow, interest charges remaining stationary. Three of the farms showed a profit of £45, £29, and £28 respectively, the remainder resulting in a loss varying from £12 to £199, on the basis of £7 per cow for labour.

Production Costs per Pound of Butterfat.

The per-pound cost of producing butterfat on the interest and labour basis fixed (£7 per cow for wages, and 6 per cent. interest plus 1 per cent. sinking fund) varies from 33·3d. to 18·6d., with a general average of 23·2d. The effect of low-producing cows on partially developed land is clearly demonstrated. To put these farms on an economic basis an increased production of 48·8 lb. per cow, or 11·01 lb. per acre, is required, provided other items remain the same.

Top-dressing.

The fertilizers used for top-dressing amounted on an average to 9·563 tons, but this was applied to that area actively devoted to dairying only. If the whole of the land were in use and manured proportionately the amount used would have been 14·6 tons. When considering the weight of manure used on dairy farms it is the amount used per cow rather than per acre that is of economic importance, and it is found on low carrying-capacity farms with herd averages comparatively low that the manure cost per cow or per pound butterfat is much higher than is the case on high carrying and producing farms. For the Piako County group reviewed in the *August Journal* 2·33 lb. of manure was used for every pound of butterfat produced, while for the group here under consideration the amount was 4·89 lb., or on a per-cow basis 6·04 cwt., against 8·45 cwt.

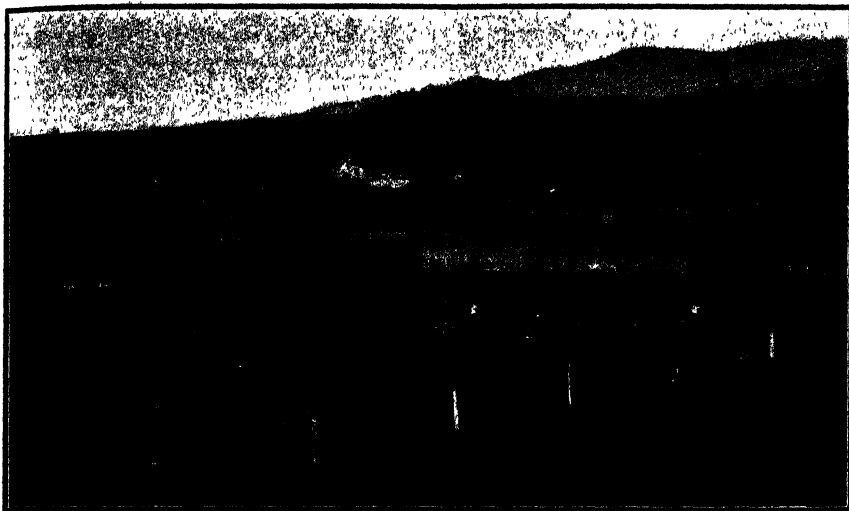


FIG. 3. A DAIRY FARM OF THE LOCALITY.

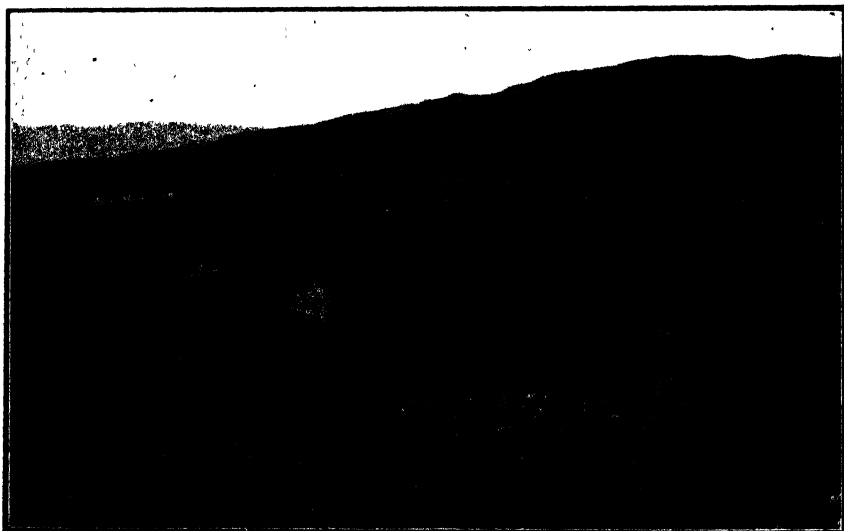


FIG. 4. FARM ON TYPICAL EASY HILL COUNTRY.

[Photos by H. Draks.]

Analysis of Mixed-farm Figures.

A summary of the position of mixed farms will be found in Table 4, placed contiguously to Table 3 for ease of comparison with dairy farms. The number dealt with is small, but serves to indicate the pros and cons of the two types on similar land. The average area is considerably larger, but dairy-products are the dominant source of income. On these farms only a limited area is used for butterfat-production, cows being wintered on rougher pasture. Herds are comparatively uniform in size, but decrease per 100 acres as the total area increases.

Although there are a number of high-producing herds the general average production of butterfat per cow is below that for dairy farms proper, being 188.94 lb. against 193.26 lb. The range is from 270 lb. to 131 lb. per cow. The per-acre production averages 21 lb. over the ten farms.

Sheep Capacity.

As indicated in Table 1, the sheep-carrying capacity of this country is approximately $1\frac{1}{2}$ mixed sheep per acre. Of those actually carried breeding-ewes predominate, though there is a tendency on some farms to increase dry stock to cope with second growth and fern. A large proportion of lambs are sold fat off crops. The number carried ranges from 133 down to 28 per 100 acres, with an average of 80.1. The heavier sheep-carrying farms are those of larger area, where the influence of dairy cows is proportionately less.

Total Returns per 100 Acres.

The returns per 100 acres range from £311 to £111, with a general average of £232 18s. In this amount cows represent 59.682 per cent., sheep 21.597 per cent., cattle 10.133 per cent., and pigs 8.588 per cent. The average return amounts to £2 6s. 2d. per acre, varying from £3.2s. 2d. to £1 2s. 2d. Outside labour connected with sheep, such as shearing and crutching, has been debited directly to the Sheep Account.

Maintenance and Running Expenses.

In computing maintenance expenses per 100 acres the same principles have been observed as in the dairying group, with the exception of items such as woolpacks and dip, which have been debited to the Sheep Account. Expenses range from £122, or £1 4s. 4½d. per acre, to £62, or 12s. 4½d. per acre, with an average of £81, or 16s. 2½d. per acre.

Capital per 100 acres.

It will be seen from Table 5 that the total capital employed (Government valuation of land) is lower than is the case on dairy farms, land having a higher percentage value, while stock and plant are slightly lower. The influence of cows on the price of sheep-land is considerable. The range is from £1,890 to £800, with a general average of £1,420.

Total Expenses per 100 Acres.

Owing to the distribution of labour over both sheep and cows, it is not possible to compute labour capacity on a per-cow basis. Total expenses therefore represent interest on capital at 6 per cent. and 1 per cent. sinking fund, plus maintenance and running expenses.

This item is not comparable with total expenses of dairy farms. The range is from £246 to £136, with an average of £180.

Wage Capacity per 100 Acres.

The wage capacity is considerably lower on mixed farms than on dairy farms, being £51 10s. against £84 11s. 3d. To obtain the same labour reward, therefore, an area of approximately 160 acres is required under mixed farming; in other words, dairying returns 60 per cent. higher labour reward per acre than does mixed farming on this class of country. Of the ten farms two result in a loss, giving no labour surplus whatever. The highest return is £127, and the lowest minus £27.

Manure per 100 Acres.

There is a considerable amount of manure used on these farms, but as it is not applied exclusively to dairying-land it is not possible to state the amount per cow. The range per 100 acres is from 8.2 tons to 2.4 tons, with an average of 5.41. As the average area is 387 acres, it will be seen that the per-farm average is in the vicinity of 21 tons.



FIG. 5. VIEW ON MIXED SHEEP AND DAIRY FARM.

[Photo by H. Drake.

True Financial Position.

It must be appreciated that the foregoing analyses do not represent the true position of these farms, owing to a certain amount of personal capital being employed on every holding, and that 7 per cent. is not paid on all borrowed capital. By accepting the Government valuation as a basis it is possible to show the true wage and interest capacity. It is probable that many farms have cost their owners more than the amount represented by the Government valuation, but it is obvious that if this is the case the cost of such land is above its present earning-value.

Table 7.—*True Financial Position of Farms per 100 Acres.*

Subgroup.	1. Personal Capital.	2. Borrowed Money.	3. Interest paid on Borrowed Money.	4. Main- tenance Ex- penses.	5. Total Returns.	6. Interest and Wage Capacity.	7. Interest on Personal Capital at 7 per Cent.	8. Wage Capacity.
Dairy Farms. (Four Groups of Four Farms each.)								
1	£ 1052.250	£ 1450.250	£ 99.500	£ 188.250	£ 524.750	£ 237.000	£ 73.650	£ 163.350
2	1015.730	861.770	48.470	134.250	377.250	194.530	71.050	123.480
3	808.500	906.500	54.250	116.750	292.500	121.500	56.588	64.912
4	473.500	751.500	39.750	92.250	187.250	55.250	32.975	22.275
General average	837.495	992.505	60.492	132.875	345.437	152.070	58.125	93.945
Mixed Farms. (Two Groups of Five Farms each.)								
1	567.600	1088.400	67.600	91.200	252.000	93.200	39.230	53.970
2	699.600	484.400	23.600	70.800	213.800	119.400	49.000	70.400
General average	633.600	786.400	45.600	81.000	232.900	106.300	44.115	62.185

Table 7 shows for both classes of farm the amount of personal and borrowed money represented by total capital on the Government valuation basis, giving the averages of subgroups. It will be seen that interest actually paid on borrowed money is low, varying from 5 per cent. to 7 per cent. Column 6 represents the actual money handled by the farmer after interest on borrowed money, maintenance, and running-expenses are paid. Columns 7 and 8 show a division of this amount between interest on personal capital at 7 per cent. and wages. The justice of allowing interest on personal capital will not be disputed, and we therefore have wage capacity only to deal with. The average area of the dairy farms is 173.8 acres, which gives the owner £163 5s. 6d. Mixed farms average 387.1 acres, which allows the owner £240 14s. 3d. Out of these amounts all wages must be paid (shearing and crutching excepted) and the farmer's family maintained.

Table 2 indicates that on the dairy farms permanent hired labour equals 0.144 labour units per 100 acres, which is equivalent to 0.25 per 173.8 acres. The expenses of permanent labour on dairy farms is therefore £29.5 at £1 10s. per week, plus 15s. per week for keep. This reduces the family wage to £134 os. 6d. The mixed farms employ 0.13 person per 100 acres, or 0.5 per average-size farm of 387.1 acres. On the same wage-and-keep basis this represents £45 10s. per annum, leaving the owner with a family wage of £195 4s. 3d.

Table 9.—Showing "Spread" per 100 Acres in each Factor for Mixed Farms.

Cows milked.	Sheep wintered.	Total Butterfat.	Butterfat per Cow.	Returns from				Capital Value of Land, Plant, and Stock.	Expenses.			Wage Capacity.	Manure used.
				Butterfat.	Pigs.	Cattle.	Sheep.		Interest.	Upkeep and Running.	Total.		
..	..	lb. 3201.0	lb. ..	£ 213	£ ..	£ ..	£ ..	£ ..	£ ..	£ ..	£ ..	£ ..	Tons. ..
..	..	2904.5	..	193	..	..	..	..	..	..	..	..	..
18.4	..	2510.2	270	167	..	..	..	..	..	..	..	..	8.2
16.3	133	2502.4	267	167	54	..	102	..	..	..	246	127	8.1
15.8	129	2401.6	244	160	37	89	98	1890	132	122	212	112	6.3
15.7	125	2310.0	231	153	30	57	55	1880	132	115	203	99	5.6
12.0	105	2106.0	200	140	21	37	53	1870	131	82	201	67	5.5
Average 11.08	80.1	2093.56	188.949	139	20	21.7	50.3	1420	99	81	180.0	51.5	5.41
10.0	63	1390.8	185	90	16	20	45	1390	97	78	173	50	5.3
7.8	61	1200.0	154	80	13	20	44	1360	95	71	169	45	4.3
6.0	56	406.1	152	27	12	12	40	1280	90	71	168	44	4.2
5.7	54	..	136	..	11	1	27	1260	88	70	157	25	4.2
3.1	47	..	131	..	6	-1	23	1050	74	70	138	-27	2.4
..	28	..	..	..	Nil	-9	16	800	56	69	136	-27	..
..	..	..	..	..	..	-9	..	..	..	62	..	..	..

It must also be remembered that a certain amount of outside casual labour is employed for harvesting and improvement work, which must be paid out of these surpluses.

If we return for comparison purposes to the original basis of 6 per cent. interest plus 1 per cent. sinking fund on capital value of land, stock, and plant, the dairy farms earn interest at the rate of £5 13s. per cow, or £1 5s. 7d. per acre; maintenance, £5 17s. 5d. per cow, or £1 6s. 5d. per acre; and wages, £3 14s. 7d. per cow, or 16s. 11d. per acre. Mixed farms earn interest at the rate of 19s. 10d. per acre; maintenance 16s. 2d., and wages 10s. 7d., per acre.

If it is agreed that £7 per cow is not an unduly high wage allowance, then on land of this nature and under the system of cow-management practised the total capital valuation should not exceed £779 12s. per 100 acres, of which the major portion is represented by stock and plant. The most profitable farm of the group earns interest at the rate of 7 per cent. on a capitalization of £3,000, or £30 per acre, after allowing £7 per cow for wages; but at the other extreme are farms earning no interest and very small wages.



FIG. 6. TOP-DRESSING GRASSLAND.

[Photo by H. Drake.]

Conclusion.

Tables 8 and 9 give the spread of different items across the average for the dairy and mixed farms respectively. Each farmer's figures will be marked and forwarded for his information, as explained on pages 87 and 88 of the August *Journal*.

The survey has shown that the dairy farms have a considerably higher per-acre earning-capacity than have mixed farms; but with larger areas under mixed stocking conditions the total wage capacity is larger, thus allowing more margin for living-expenses. Land will be more quickly brought into a state of high production under dairying conditions on comparatively small holdings, mainly through hard work. The improvement in production of the last few years indicates that in time the present owners will be rewarded if able to hold on and increase their carrying-capacity with cows of higher-production strains.

The field-work of the survey was again carried out by Mr. I. W. Weston, M.Sc., of the Fields Division.

CONTROL OF BROWN-ROT IN STONE-FRUIT.

EXPERIMENTS WITH PEACH-TREES AT HENDERSON, 1926-27 SEASON.

Horticulture Division.

THE experiments in the control of brown-rot fungus (*Sclerotinia cinerea*) carried out by Mr. W. H. Rice, Orchard Instructor, Auckland, in co-operation with Dr. R. H. Makgill, in his orchard at Henderson during the season of 1925-26 were continued during 1926-27. The 1925-26 experiments (reported in the *Journal* for September, 1926) had again indicated the superiority of bordeaux dormant sprays for stone-fruit trees—not so much for the control of the fungus as for general reasons. Therefore all experiment sections during the season now under review were given that spray treatment when the trees were dormant and the buds commenced to break. The superior results of atomic-sulphur summer sprays during the 1925-26 season led to them being followed up by trials of different forms of atomized sulphur as a control when the trees were in leaf. They were Sulpho, atomic sulphur, and dry-mix sulphur. Sulpho is a dry-powder form of atomized sulphur. Dry-mix sulphur is a variation in the compounding of the well-known self-boiled lime-sulphur, and is made as follows:—

Soda stock solution (1 lb. caustic soda in 1 gallon water).

$\frac{1}{4}$ lb. casein (bring to the consistency of milk by adding 1 gallon water and $\frac{1}{4}$ pint soda solution, and stirring well).

16 lb. fine powdered sulphur (sift the sulphur and thoroughly wet it by adding the dissolved casein and as much more water as is necessary to bring it to the consistency of cream).

5 lb. fresh rock-lime (slake the lime carefully; dilute the milk up to 10 gallons; place it in the spray-tank, start the agitator, add the "creamed" sulphur, and then water to make it up to 100 gallons).

The relative freedom from brown-rot of the check trees in the present experiment may be attributed to the large amount of free sulphur in the orchard, which was so pronounced as to be detectable some distance away; also, no doubt, to the general cleanliness of the orchard. All dead wood, prunings, and mummified fruits were gathered and destroyed, and infected fruit was gathered at short intervals during the season. It is therefore more to orchards in the locality that one must look for comparisons; the loss of fruit from the ripe-rot form of this disease in such orchards is estimated at 25 to 40 per cent., according to the amount of spraying done and the class of sprays applied.

During the winter of 1926 the trees on the area were methodically pruned. Special attention was given to the removal of all dead or diseased wood, also of mummified fruits. All prunings, &c., were carefully collected and removed from the area and burned. The land was ploughed, with the exception of the strips between the trees, prior to bud-movement.

DORMANT-PERIOD SPRAYS.

At bud-movement all trees except Paragon were sprayed with bordeaux, 5-4-50. Paragon, owing to its extra susceptibility to leaf-curl in this district, received bordeaux, 8-6-40, and all the trees were

sprayed with oil, 1-17, the following day. The area had been divided for treatment into three sections as follows :—

Table 1.

Varieties.	Section 1.	Section 2.	Section 3.	Total Trees.
Paragon	52	76	59	187
Carmen	19	24	32	75
J. H. Hale	9	3	0	12
Hay's Cling	7	7	9	23
Golden Queen	9	16	17	42
At	0	0	9	9

SUMMER SPRAYS.

Later sprays applied to each block are shown in the following table :—

Table 2.

Stage of Growth.	Section 1.	Section 2.	Section 3.
Pink, full pink, and petal-fall	Sulpho, 10 lb. to 100 gallons ; all varieties	Atomic sulphur, 10 lb. to 100 gallons	Dry-mix sulphur (16 lb. sulphur, 5 lb. lime, 8 oz. casein, 100 gallons).
Fruit-setting.. ..	Ditto	Ditto	Ditto.
Three weeks later ..	Ditto	Ditto	Ditto.
Three weeks later ..	Ditto	Ditto	Ditto.
Prior to ripening ..	Same spray—Carmen only	Ditto ; Carmen only	Ditto ; Carmen only.
Ripening	Same spray—all varieties except Carmen	Ditto ; all varieties except Carmen	Ditto ; all varieties except Carmen.

A cross-block consisting of 15 Paragon, 10 Carmen, 11 Golden Queen, and 6 Hay's Cling was left unsprayed after 18th October as a check for ripe-rot. This gave a test of Sulpho *versus* atomic sulphur *versus* dry-mix sulphur, each on an initial spray of bordeaux.

CONTROL OF SPRING INFECTION.

Spring forms of brown-rot infection showing were bud-rot, twig-rot, and blossom-rot. These forms showed practically the same degree of susceptibility of tree variety as prevailed under the test carried out the previous season, and the matter is apparently largely one of varietal resistance. Paragon was outstanding in this respect. The following observations were made :—

Carmen: Bud-rot and blossom-rot very bad ; twig-rot bad. Loss equal to 98 per cent. of crop as indicated by bud-development.

Golden Queen: Bud-rot medium ; twig-rot bad. Loss of crop, as indicated by bud-development, considerably less than previous season, a medium setting of fruit showing.

J. H. Hale: Twig-rot prevalent. These trees had only a medium blossoming, which set erratically. Bud-rot showing on Section 2 only.

Hay's Cling: Twig-rot and bud-rot light. Fair setting of fruit.

Paragon: No bud-rot or blossom-rot. Good setting in all sections.

None of the sprays applied gave thorough control of spring infections of brown-rot, excepting on Paragon.

CONTROL OF SUMMER INFECTION ("RIPE-ROT").

Comparative fruit-infection on the three sections was as follows:—

Table 3.

Section.	Spray.	Check Trees.	Summer-sprayed Trees.
1	Sulpho	10 per cent.	7 per cent.
2	Atomic sulphur	10 per cent.	10 per cent.
3	Dry-mix sulphur	8 per cent.	5 per cent.

In Section 1 the effect of Sulpho was certainly beneficial, this being specially so on some trees which had been consistently bad for ripe-rot. Atomic sulphur was not as effective as anticipated, and showed the highest percentage of ripe-rot of the three sulphurs tried. Dry-mix sulphur proved the most effective on all varieties. The growth and foliage on the whole of this plot were far above normal years, which seems to show that, besides checking brown-rot, sulphur in a finely divided form has a very beneficial effect on the trees generally.

The season was a very wet one, with muggy conditions prevailing during the ripening-period, and brown-rot was very prevalent throughout the whole district—in a measure far in excess of that indicated by the check trees. As already stated, these were probably influenced by the abundant free sulphur present in the orchard, and the value of some form of sulphur spray during the summer was well demonstrated.

SUMMARY.

Bordeaux as a delayed dormant spray is the most satisfactory base. Bud-rot, blossom-rot, and twig-rot on all varieties except Paragon were not fully controlled by any of the sprays used. Degree of infection was largely a matter of susceptibility of variety, Paragon being outstanding in that respect.

Sulpho, 10 lb. to 100 gallons of water, gave reasonably satisfactory control of summer fruit-rot.

Atomic sulphur, 10 lb. to 100 gallons, although giving fair control, showed the highest percentage of summer rot of the three sulphurs tried.

Dry-mix sulphur gave the best control, the percentage of summer fruit-rot being less than with either of the other two treatments; moreover, the growth and foliage were outstanding in quality and general healthy appearance.

PUWERA GUM-LAND EXPERIMENTAL FARM.

NOTES ON OPERATIONS, SEASON 1926-27.

T. H. PATTERSON, H.D.A., Instructor in Agriculture, Auckland.

DAIRYING.

THE season of 1926-27 completed the second year of dairying at the Puwera Experimental Farm. The herd consisted of six heifers, nine second calvers, and six mature cows—all grade Jerseys of good type. The herd was again tested, and the average return of the twenty-one head was 282.8 lb. butterfat. The average period in milk per beast was 263 days. This represents an average improvement of 62.8 lb. of butterfat per head on the preceding season's return. The highest individual yield was 369.1 lb., and the lowest 209.7 lb. Most of the cows calved in August and September, but two calved in July, while four heifers came in after September, and one was as late as November. We have been able to maintain the stock-carrying capacity of the land at a cow to 2 acres.

The season proved a favourable one for pastures. Copious rains throughout the milking season sustained succulent and adequate herbage, and supplementary feeding, though resorted to, was almost unnecessary. The writer is of the opinion, however, that recourse to supplementary feeding proved beneficial. Cows appreciate a change of feed, even when pastures are luscious and growing well right through the season. At Puwera we have English grass pastures with a good proportion of clovers present; there are also *paspalum*-clover pastures and areas of *kikuyu*-grass. In addition to the changes supplied by these pastures, Japanese millet, soft turnips, maize, and grass silage were fed. It is claimed that such varied feed induces the stock to eat more, and that, therefore, they maintain a better flow of milk. Even when a season proves entirely favourable for pastures, supplementary crops and fodders are thus worth while.

Hay, mangolds, and swedes were fed out on the farm in the winter months.

WATER-SUPPLY.

Owing to regular rains, water-supply was adequate during the year. A bore was put down on the ridge in Field 5 to a depth of 300 ft. For the first 18 ft. the bore went through white pipeclay, and from that depth onward to 300 ft. through hydraulic limestone, probably a continuation of the Portland beds. Failing to make a good strike of water, the bore was abandoned after a depth of 300 ft. had been reached, and a dam, fed by springs, was made in Field 4. There are 11,000 gallons of good water impounded in the dam. The dairy shed and troughs are supplied from this reservoir by means of pipes, the water flowing by gravitation. The dam was merely dug out of the clay, which holds the water quite well.

EXTENSION OF DAIRY FARM.

Up to the time of writing this year 41 acres of pasture have been added to the dairying area, making a total of approximately 100 acres

of improved land. This will allow of about 40 cows being carried in the present season, and with other stock, including a bull, calves, yearlings, pigs, and three horses, the equivalent of a dairy cow to 2 acres will still be maintained. The shed has been altered and a three-cow milking-machine installed.

The new grass areas which were broken in from the virgin gum-land, using cultivation methods described in the *Journal* for November, 1926, are looking well and promise to make good permanent pastures. A portion of the cost incurred with previous breaking-in methods—by extra cultivation and a long fallow in addition to a preliminary dressing of lime—has been put into extra phosphatic manure, and the results so far seem to indicate that the latter, which is cheaper, is more profitable. This consideration is an important one, because it promises to reduce the cost of the breaking-in process, a matter of some consequence to a settler improving gum-land and having only a limited capital at his disposal.

EXPERIENCE WITH FERTILIZERS.

Pastures on the farm as a rule are treated each year with 2 cwt. to 3 cwt. of basic slag, or in some cases with basic super. The upper portion of Field 6, $2\frac{1}{2}$ acres in extent, was again cut for hay. This area consists chiefly of *paspalum*, *Lotus major*, and white clover, with a sprinkling of rye-grass. Before being closed in the spring it was dressed with fish fertilizer (analysis—nitrogen 7.6 per cent., tricalcic phosphate 28.1 per cent.) at the rate of 1 cwt. per acre. The response was very satisfactory, and, since lack of nitrogen is a definite limiting factor on the white pipeclay soils, one is not surprised. About 7 tons of hay were cut from the area (Fig. 2). The fish fertilizer was supplied by Sandford Ltd., of Auckland. Our results with crops also were equally good where this vehicle for nitrogen was used. In fact, the results have been so promising that it is intended to include fish fertilizer in our systematic field experiments where nitrogen has been ordinarily used in the form of blood, sulphate of ammonia, or nitrate of soda.

Seychelles Island guano was used as a preliminary dressing on soil prepared for sowing to permanent pasture. It was applied at the rate of 9 cwt. per acre on Field 9 a few weeks before sowing the grass-seed. Side by side was an area on which 9 cwt. per acre of basic slag was applied on the same day as the guano. Three hundredweight per acre of super was applied with the grass-seed, which was sown in the middle of April last. The take of grass was satisfactory, but the plots which received the extra phosphate in the form of Seychelles guano and basic slag respectively presented a striking contrast to the check plot, which only received the 3 cwt. of super with the seed. The point is an interesting one. The response to phosphate is very marked. Why not increase the dressing on soils where the fertility is naturally much below the average? If one can get a good sward of grass quickly by using from 10 cwt. to as much as 13 cwt. of phosphate per acre, it is highly probable that the generous treatment will pay. The good pasture produced will carry stock, and thus give quick returns of marketable products, this in turn allowing the farmer to continue generous treatment of the land. In the case of gum-land of the Puwera type this seems to be the best course.

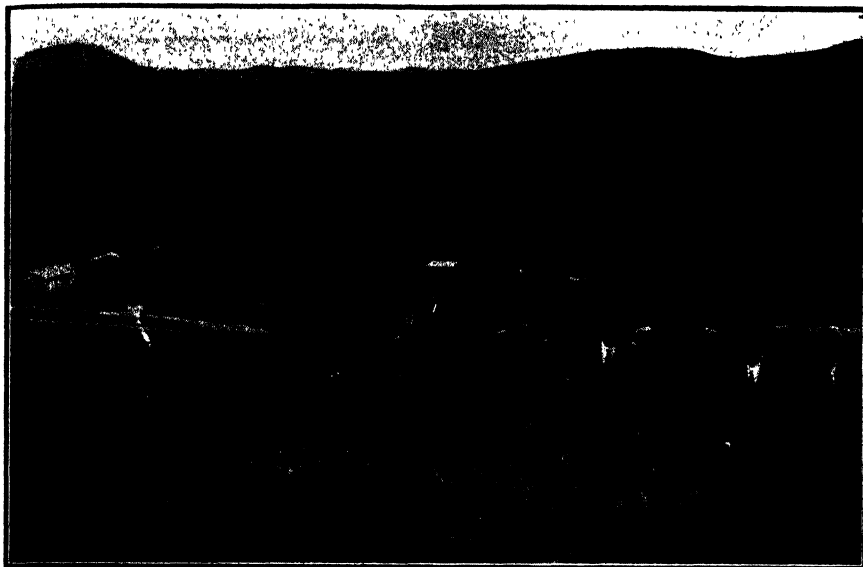


FIG. 1. GENERAL VIEW OF THE FARM FROM FIELD 5.

Dairy shed and yards in centre middle distance, overseer's house on extreme left. New grass area across creek in distance. Photo taken on occasion of visit of Auckland Agricultural Science Club.

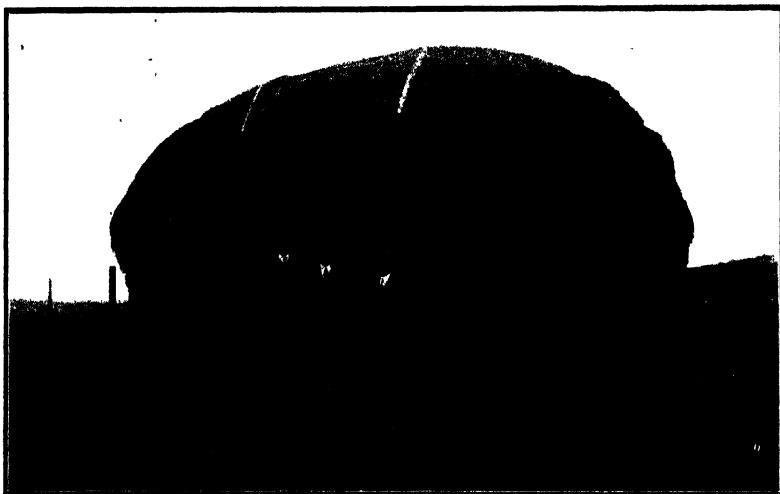


FIG. 2. HAY CUT FROM $2\frac{3}{4}$ ACRES IN FIELD 6.

The pasture was top-dressed with fish fertilizer before being closed.

GUM-LAND PROSPECTS.

As already mentioned, the average return per cow last season was 282 lb. of butterfat. When the dairy herd reaches a more mature stage the average should be well over 300 lb. The pastures at Puwera show steady improvement each year; hay can be made and silage conserved without difficulty; special crops to supplement the pasture can be easily grown, and all stock do well on the area. These facts, together with the satisfactory returns from dairying, demonstrate that when the time does arrive for greater utilization of these gum-land areas the soils will respond well to reasonable treatment. They now represent, thanks largely to the excellent climatic advantages of North Auckland, a very large area of potential dairying and general-farming land still unoccupied, only needing capital and the proper treatment to bring it into profit. The good result secured at Hautu and Rangipo, in the central pumice areas, by the use of prison labour suggests a practicable means of improving gum-land for settlement on a similar scale.

NAURU AND OCEAN ISLANDS PHOSPHATE INDUSTRY.

SHIPMENTS of phosphate from Nauru and Ocean Islands for the year ended 30th June last the seventh under the control of the British Phosphate Commission—were approximately 593,300 tons, as compared with the previous highest output of 470,700 tons in 1924–25, an increase of about 122,600 tons. This result was owing mainly to unusually favourable weather throughout and satisfactory labour and health conditions. During 1925–26, when adverse weather and labour conditions were experienced, shipments were only 391,700 tons.

Deliveries of Nauru-Ocean phosphate to New Zealand for 1926–27 were approximately 135,200 tons, as compared with 77,400 tons for the previous corresponding period. These quantities, however, were insufficient to meet the rapidly increasing demand, and the Commissioners purchased on behalf of the fertilizer manufacturers considerable quantities of phosphate from outside sources at the lowest prices obtainable, though at a considerable increase on Nauru-Ocean rates. This outside phosphate is of lower quality, but by judiciously mixing it with the relatively large supply of high grade the manufacturers have been able to maintain the high standard of phosphatic fertilizers obtaining in this market.

With the object of increasing the output from both islands an extensive programme of development has been decided on, starting with an improvement of the shipping facilities. Contracts were signed in March last with Messrs Henry Simon, Ltd., of Manchester, for the construction of a loading cantilever at Nauru and an improved steel jetty at Ocean Island. This work will probably extend over two years, entailing an expenditure of about £250,000, which will be financed by the Commission.

The cantilever for Nauru embodies some unique features suited for the special conditions pertaining there. It will project about 180 ft. beyond the edge of the reef, and will permit of discharging the phosphate direct into the vessel's fore and after holds simultaneously, thus dispensing with the present system of loading by means of small lighters. The material will be transferred from the 12,000-ton shore storage bin to the discharging-points of the cantilever by rubber-belt conveyers with a total capacity of 600 tons per hour, thus enabling the loading of a 6,000-ton vessel in a day. The outer arms of the cantilever will operate on the principle of a wharf-crane, permitting them to swing in on the reef when not in use. The whole plant will be operated electrically. It is hoped that on completion of the cantilever installation the annual output capacity will be increased to between 700,000 and 770,000 tons.

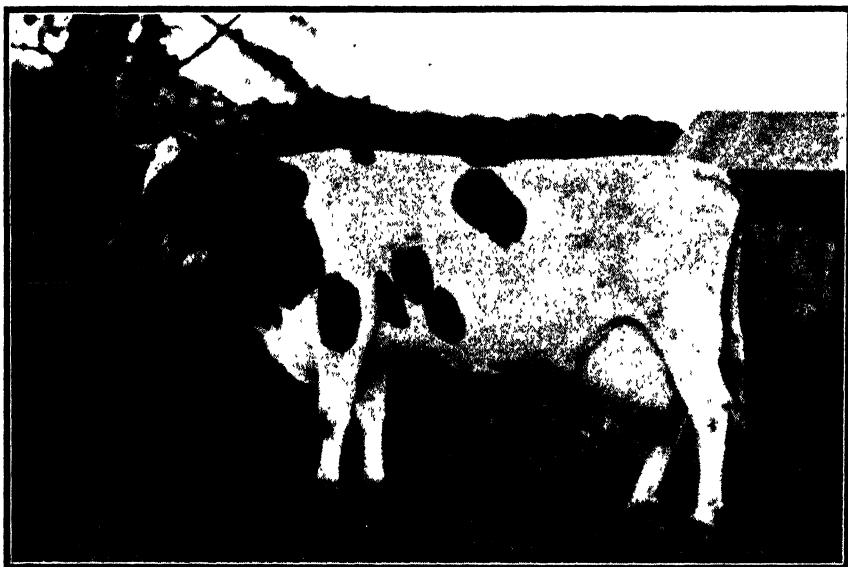
Other improvements facilitating production and transport are also to be put in hand at both islands, with a view to getting the best possible service from the improved shipping arrangements.

MONAVALA QUEEN BESS.

SIXTH C.O.R. 1,000-lb.-BUTTERFAT COW.

Dairy Division.

THE name of the Friesian cow Monavale Queen Bess needs no introduction to *Journal* readers interested in the performance of our pure-bred dairy cattle. In September, 1921, she completed a certificate-of-record test on which she gained a certificate for 740·50 lb. butterfat from 20,501·1 lb. milk. This yield, made at the commencing age of 2 years 16 days, placed her at the head of the junior two-year-old Friesians, and the record still stands as the highest for that class.



MONAVALA QUEEN BESS (T. H. RICHARDS, CARDIFF).

C.O.R., 1927, in Friesian mature class 26,461·8 lb. milk, 1,002·20 lb. butterfat

The following year, commencing at the age of 3 years 56 days, she concluded test with 21,609·3 lb. milk containing 800·18 lb. butterfat, which remains the junior three-year-old class-leadership record. A third certificate was gained in 1924-25, her production then reaching the further advanced figure of 950·90 lb. butterfat from 25,598·0 lb. milk in 333 days. On that occasion illness curtailed her testing-period.

By calving subsequent to test on the 11th of last month, Monavale Queen Bess completed a test which entitled her to the coveted distinction of a 1,000 lb. record. Commencing test at the age of 7 years 363 days, she produced in the ensuing 365 days 26,461·8 lb. milk containing 1,002·20 lb. butterfat. Her four certificates of record thus

represent an average butterfat-yield of 873 lb.—the highest performance of its kind for New Zealand. For the record just completed the period between calving for commencement of test and calving subsequent to test was 410 days. Her calving for commencement of test was 332 days later than the preceding calving, which means that she has had three calvings within two years and some twelve days.

Monavale Queen Bess was milked three times daily during the whole of her lactation period. As our breeders know, the New Zealand C.O.R. rules restrict the number of daily milkings for test cows to three. In other countries, particularly the United States of America, high-producing cows under test are usually milked four times daily, while there are several instances of record-breaking animals being milked even six times daily during their flush period. New Zealand test cows are therefore handicapped to a certain extent when competing with foreign champions.

While, however, it is very gratifying that New Zealand possesses dairy cows which are capable of ranking high among the world's leaders, we are of the opinion that a general high standard of production is of more benefit to the country than a few record-breakers. Our C.O.R. rules were designed with special attention to ordinary herd conditions, hence the stringent calving qualifications and the restriction to not more than three-times-a-day milking. Had it not been that after a cow produces more than a certain quantity of milk mere humaneness demands thrice-daily milking, it is possible that the C.O.R. rules might not have permitted more than twice-a-day milking. The fact that we have cows which under these severe test conditions can attain to such creditable standards of production adds to the merit of Monavale Queen Bess and those other animals with which she ranks.

Monavale Queen Bess is the sixth cow to yield more than 1,000 lb. of butterfat under our New Zealand rules for first-class certificates of record. The list, comprising three Friesians and three Jerseys, together with particulars of performance, is as follows:—

Name of Cow.	Breed	Yield			Age at Start of Test.
		Days.	Milk.	Butterfat.	
			lb	lb.	Yrs days.
Alcartra Clothilde Pietje	Friesian ..	365	31,312·5	1,145·24	7 357
Holly Oak's Annie ..	Jersey ..	365	18,522·7	1,056·49	5 9
Hilda Minto de Kol ..	Friesian ..	365	27,773·8	1,046·31	12 56
Vivandiere ..	Jersey ..	365	17,282·1	1,036·09	6 10
Pretty's Flirt ..	Jersey ..	365	16,684·1	1,010·49	6 353
Monavale Queen Bess ..	Friesian ..	365	26,461·8	1,002·20	7 363

A conspicuous feature of Monavale Queen Bess's production figures during the last season under test was her extremely uniform yield month by month for the greater portion of the period. It was the uniformly high standard of production rather than an abnormally high production in any individual month or months which resulted in the fine aggregate yield for the year. For the first six full months of her test she was credited with over 100 lb. butterfat per month,

while her heaviest yielding month—October, 1926—credited her with 115 lb. In other words, for six calendar months the extreme variation in monthly butterfat-production was only 15 lb. For the final four months of her test the yield declined rapidly, mainly due to indisposition. Had her good health continued to the conclusion of the test it is probable that her season's butterfat aggregate would have been appreciably higher.

Monavale Queen Bess was born on 31st July, 1918, at "Monavale," near Cambridge, Waikato, and was bred by Mr. C. C. Buckland, whose stud produced many outstanding foundation animals of the breed in New Zealand. It was at Mr. Buckland's dispersal sale that Monavale Queen Bess was purchased as a yearling heifer by her present owner, Mr. T. H. Richards, of Cardiff, in whose ownership she has since remained. Thus Mr. Richards has piloted her through the four highly successful C.O.R. testing-periods.

The pedigree of Monavale Queen Bess has been referred to in detail on two previous occasions in the *Journal*, but for those readers not conversant with the facts it may be repeated that she is by King Laddie from Netherton Pontiac Princess. In addition to Monavale Queen Bess, King Laddie has sired seven other C.O.R. cows. Netherton Pontiac Princess was not tested under the C.O.R. system, but there is evidence of her quality. In appearance she is every inch a producer. Through Woodcrest Pietje Pontiac—sire of eleven C.O.R. daughters, two of which have certificates for over 800 lb. butterfat—and Netherland Princess 4th, who, with 805.77 lb. butterfat, has been leader of the senior two-year-old Friesians since 1914, Netherton Pontiac Princess goes back to Paul Pietertje, King Segis Pontiac, and other individuals which helped to make history for the breed. Through her sire, King Laddie, Monavale Queen Bess traces to an equally distinguished line of ancestors, some of the better-known being Sir de Kol Inka Pietertje, Manor Beets Daughter 2nd of Ashlynn, and Cliffside Laddie.

Even from these brief notes it will be apparent to students of the Friesian breed that the combination of such ancestry might be expected sooner or later to concentrate exceptional productive ability in some individual such as Monavale Queen Bess. The accompanying photograph will serve to show that she looks the part.

Rabbit Control—In his annual report for 1926–27 the Director-General of Agriculture remarks as follows. "A great improvement has taken place in the position throughout the Dominion as regards rabbits, these being less in number and better under control than has been the case for many years past. Rabbit Boards, where established, have done very good work, and, so far as their districts are concerned, are to be congratulated upon the results attained. Those officers of the Department responsible for carrying out the provisions of the Rabbit Nuisance Act may also be commended, as the present good position must be held to be largely due to their efforts over a period of years of onerous and often unpleasant work. A much greater spirit of united effort between farmers and Inspectors is noticeable, and this is very satisfactory from all points of view."

THE BLACKBERRY PEST.

(Continued from June issue.)

II. DISTRIBUTION.

E. F. NORTHCROFT, M.Sc., Biological Laboratory, Wellington.

WITH a plant so remarkably resistant and strong-growing, and one possessing such adequate and sure means of reproduction by seed, and propagation by means of its rooting-stems, runners, and cuttings, there is little wonder that under New Zealand conditions blackberry has invaded such extensive tracts of land. Its spread can be amazingly rapid; places a few years ago with perhaps only a single apparently struggling plant are now a dense mass of tall impenetrable bushes.

The species *Rubus fruticosus* Linn. is a common plant in Europe—its natural home—being especially abundant in hedges, thickets, woods, along streams, and on all waste lands. It occurs over nearly the whole of Europe (including Russia) and Central Asia, and is also found in northern Africa; but nowhere does it extend to the high altitudes. In Britain it is specially abundant; but nowhere in these countries does it appear to have become a menace or to have given any cause for alarm by its rapid method of spread. There appear to be numerous varieties of *R. fruticosus*. Babington distinguishes forty-five, while Rogers claims to have divided the group into fourteen subgroups comprising over 120 varieties. According to Cheeseman there have been introduced into New Zealand the following subspecies: *R. discolor* Weihe and Nees, *R. leucostachys* Smith, *R. rusticanus* Weihe, *R. macrophyllus* Weihe, and *R. laciniatus* Willd, the two most distinct forms being *Rubus fruticosus*, the common bramble or blackberry, and *R. laciniatus*. In mentioning the blackberry, Cheeseman says, "Copiously naturalized throughout, and probably the most troublesome weed in New Zealand."

Blackberry has been introduced into South Africa, being quite common in some places, especially about Lion and Table Mountains, and also near Klapmuts. In Queensland the plant has also become established, having been brought from Europe, and is now regarded as a noxious weed; but nowhere is it so abundant or troublesome as in New Zealand.

INCIDENCE OF THE PEST IN NEW ZEALAND.

Every county in the North Island and South Island has its blackberry-bushes; but the weed is not so abundant as perhaps commonly supposed. It is certainly seen along some of the railway-lines, occasionally in considerable abundance, and close to some of the railway-stations, especially in the far North. But if one were to travel by train from Wellington to Napier, or from Christchurch to Dunedin, one could count the blackberry-bushes with ease, and this affords a very good indication of the degree of occurrence of the weed on the surrounding holdings. Along river-banks the weed is more common, and is almost always found in places frequented by campers and picnic parties. It is on the waste lands that the really dense areas are to be found—

areas which if cleared would not be suitable for farming. On the better country it is found mainly on blocks held by Natives and on the land not properly farmed. Though one frequently speaks of "blackberry-infested" land, this does not necessarily mean that all the area has a dense covering of the weed. If all the farmable land in New Zealand rendered entirely useless by the presence of blackberry were surveyed, it would not amount to a very great number of acres compared with the aggregate area of this class.

Blackberry is able to flourish on land both flat and hilly, good and poor, but it is seldom that the plant is found on the first-class land or on small holdings—a fact which seems to be significant. In competition with other plants the established blackberry shows itself to be by far the stronger. In some places the weed has managed to secure a footing in reserves of native bush, and here it is seen that the plant, though it has only weak flexible stems, which unaided it cannot hold upright, is able (in the presence of a support) to reach the tops of the supporting vegetation in quite a short time, in its anxiety to expose its leaves to light and air.

As already indicated, it frequently occurs that blackberry is thicker, and the affected areas are greater, where the largest blocks of land are held. Where the holdings are small, though they may be infested, the land is not rendered unproductive, as the weed is kept under control. But although the large blocks present an admitted problem in regard to yearly clearing, it must be pointed out that it is from such infested areas, where the plant is allowed to flower and fruit freely, that seed is carried by birds and left to germinate and so infest clean land many miles away. Though the germinating-power of the seed, even after it has passed through birds, is small, yet it is not necessary for a bird to carry many viable seeds before the pest has been introduced into a hitherto clean locality. Supposing, for example, the commencement is with one seed, which germinates and grows for three years before it flowers and fruits. If from the numerous seeds produced only twenty-five from each plant grow, then at the end of twelve years the descendants of the one original plant would number no less than 107,101. Fortunately, they do not all survive.

PRINCIPAL AFFECTED DISTRICTS.

The districts most seriously affected by blackberry are probably the west coast of the South Island, Taranaki, and northern Hawke's Bay, where the plant flourishes with extraordinary vigour.

It is in Westland that the largest and strongest-growing bushes are to be found; but probably much of the infested land, were it cleared, would be of little or no use for farming. In this district blackberry is specially prevalent round old deserted townships or mining camps, where the plant can be seen smothering the tallest trees of old orchards.

In northern Hawke's Bay the part most severely affected is Wairoa County, where there are several thousand acres of more or less infested land. Among notably badly infested areas in the district are those at Tangoio, Mohaka, Te Ringa, Mahia, and Opoutama. Fig. 20 is a map of part of the county, on which have been shaded in some of the largest infested areas. These are necessarily only very approximate, as

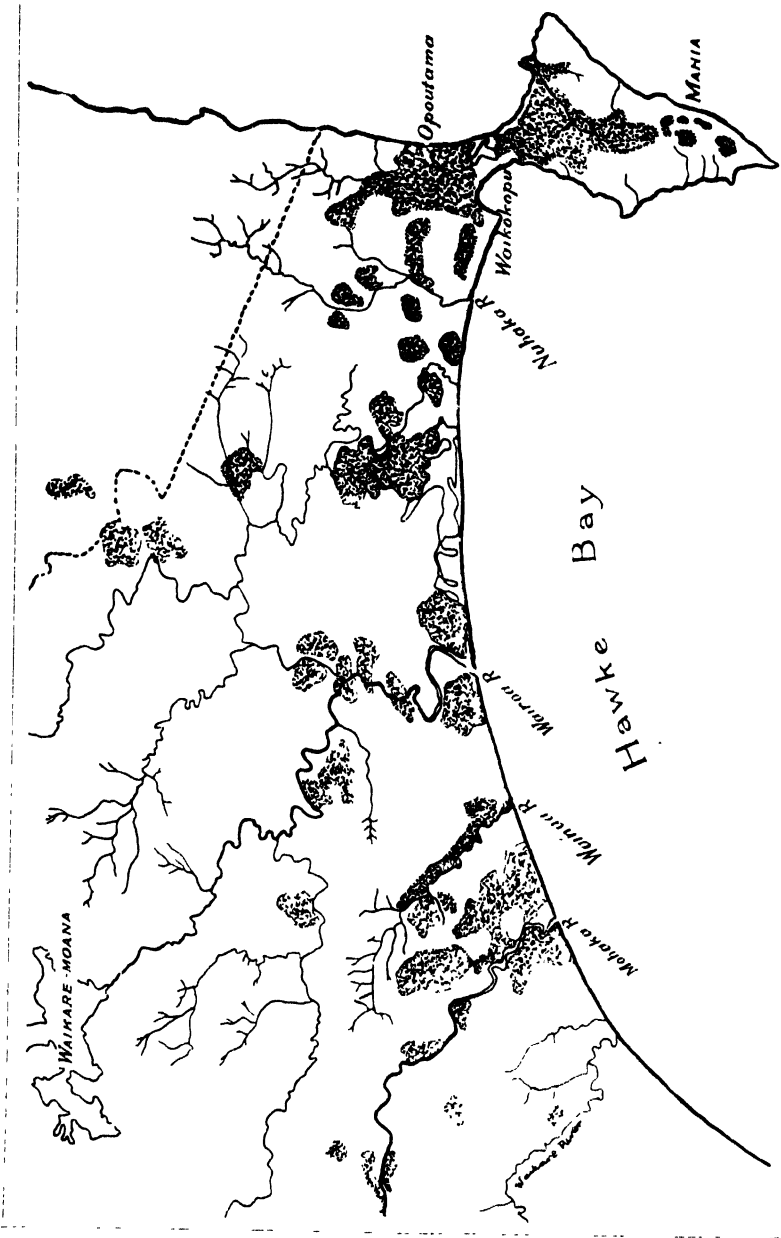


FIG 20. MAP OF PART OF WAIROA COUNTY, SHOWING PRINCIPAL BLACKBERRY-INFESTED AREAS (SHADED)

it was not possible to make any very exact survey, but they represent areas of scattered blackberry as well as those which are more or less densely covered. The map will at least serve to indicate the position generally, and to give some idea of the relative proportion of clean and infested land.

III. CONTROL.

It is when there are only scattered plants of blackberry in a district that the work of destruction should and could be carried out. Expensive methods can be applied to small scattered areas, while it would be out of the question to use anything but cheap methods of eradication, or, failing that, partial control, on the badly infested areas.

In the destruction or control of any weed pest it is in the outlying areas that the first attack should be made. Each weed will have some

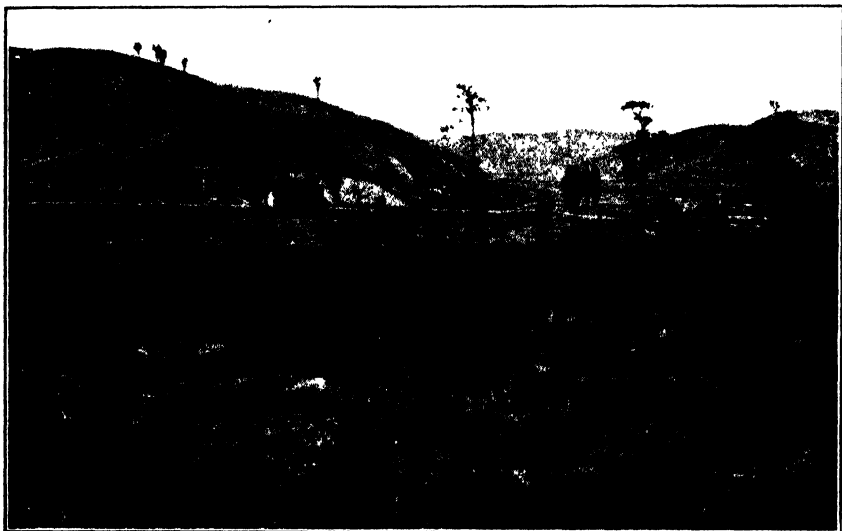


FIG. 21 DENSE MASS OF BLACKBERRY ON FLAT LAND NEAR WAIROA.

Individual bushes in this mass are some 7 ft. high.

[Photo by F. I. Northcroft.]

centre of distribution at which it is most dense ; it is from this centre that the plant will spread in every direction, and the farther one moves away from the centre the more scattered the plants become. It is at the circumference that methods of treatment should be applied, and from it one should work gradually towards the centre, where the main mass can eventually be attacked. Unfortunately, the usual method in this country is not to trouble about the circumference of spread, but to rush in and perhaps spend years attacking the dense centre, where little or no good is done. In the meantime the then circumference has become badly infested, and the range of infestation has been gradually extended farther and farther from the original centre, the rate of increase becoming more rapid as time elapses.

ESTABLISHMENT OF EXPERIMENTAL STATION.

After carefully considering the problem of control the Department of Agriculture decided to establish a special blackberry experimental station in Wairoa County. In June, 1925, mainly for the purpose of testing the effect of chemical compounds, an area of 40 acres of dense hillside blackberry, which had been left untreated for several years, was secured. This land is situated on the Te Uhi Block, four miles from the Town of Wairoa, along the Gisborne Road. A shed was erected for storing tools and chemicals immediately on securing the lease, and a tank installed, a spring a few chains up at the head of the valley, giving a small but constant supply of water, being tapped.

LINES OF INVESTIGATION.

In a research of this nature there are several main lines of investigation open. In the present case these are: (1) Chemical; (2) biological—(a) fungus parasites, (b) insect parasites; (3) ecological.

Under the first heading—chemical investigation—it is necessary to ascertain what chemical compounds and combinations of these compounds used as solids, liquids, or gases affect the plant, at the same time determining their relative effect.

By biological investigation is meant the testing of parasites, both fungus and insect, used separately or in combination with each other. Consequently tests are necessary to determine, firstly, what parasites attack the plant, and, secondly, the extent of the damage. If no single parasite seems to have any marked permanent effect, then a combination of parasites should be tried—for instance, one which destroys the young shoots or flower-heads with another which acts as a borer in the crown, and so on.

Ecological investigation is, very broadly speaking, a study of the relation between blackberry and other plants, the effect of such plants, conditions of growth, soil, climate, &c.

Failing any successful method of complete eradication, then the way lies open to investigate methods of more partial control. Under this category must be considered experiments in (1) farm-management by means of (a) manurial top-dressing, (b) cropping, (c) use of live-stock; and (2) afforestation.

(To be continued.)

Pasteurization in Cheesemaking.—Last season the quantity of cheese made with pasteurized milk in the Dominion equalled some 86 per cent. of the total output, as against 76 per cent in 1925-26.

Animal-breeding.—The chief British centres for research in animal-breeding are to be found at Edinburgh and Cambridge Universities. A grant has recently been made out of the Empire Marketing Fund towards the cost of establishing a Chair of Genetics at Edinburgh University and the development of the Animal Breeding Department. Financial assistance has also been given by the Empire Marketing Board towards work on the reproduction and growth of animals carried on under the Faculty of Agriculture at Cambridge University.

WHEAT-MANURING EXPERIMENTS IN CANTERBURY, SEASON 1926-27.

(Concluded.)

A. W. HUDSON, B.Sc., B.Ag., Instructor in Agriculture Christchurch.

Experiment 4 : Farm of R. T. McMillan, Irwell.

IN the seasons of 1923-24 and 1924-25 experiments similar to those being conducted elsewhere during those periods were carried out on Mr. McMillan's farm. The results (see *Journal*, April, 1925, pages 231 and 234) showed nothing significant from the use of phosphatic manures. This somewhat anomalous lack of response to the fertilizers cited indicates (1) that there is an ample supply of phosphate present in the soil, or (2) that some other factor is limiting the effects of the applied phosphates. The results of analyses made at the Department's Chemical Laboratory show a high amount of available phosphate (0.056 per cent. and 0.058 per cent. of citric soluble P_2O_5 from two different fields). This would indicate that the first hypothesis may be fairly correct, although equally high percentages of available P_2O_5 were shown on other areas known to respond quite markedly to the application of phosphatic manures. The lime-requirement shown by the analyses for the two fields in question was approximately 3.1 and 2.3 tons per acre respectively. Apparently, then, lime was deficient.

IN the season of 1926-27 an experiment as described below was carried out with the object of determining what factor, if any, other than that of the phosphate present in the soil was limiting production. Date of sowing, 9th June, 1926; date of harvesting, 22nd January, 1927; variety, College Hunter's; seeding, $1\frac{1}{4}$ bushels per acre. Previous history of field—1925-26, peas; for several years prior to this the field was in grass. The soils from neighbouring fields, analysed at the Chemical Laboratory, were described as a loam and a silty loam respectively.

The manurial treatments applied per acre were—

- (1) Control (no manure).
- (2) Super, 42/44 per cent., 1 cwt.
- (3) Nitrate of soda (15 to 16 per cent. nitrogen), 96 lb.
- (4) Super, 1 cwt., and nitrate of soda, 96 lb.
- (5) Super, 1 cwt., and sulphate of potash (48 per cent. K_2O), 1 cwt., plus nitrate of soda, 96 lb.
- (6) No. 5 treatment, plus 1 cwt. carbonate of lime.

NOTE.—All nitrate of soda was applied on 9th September.

Eight replications of the above series were sown, the plots being one width of a seven-coulter drill and 6 chains long. Prior to sowing of the plots half the area was treated with carbonate of lime, at the rate of 17 cwt. per acre, in the following manner: The tubes were removed from the drill so that the lime could fall freely to the ground; the coulters, which were left on, caught a good proportion of the lime and guided it into the soil, while somewhat more than half was broadcasted on the surface. This was done across the direction of sowing of the plots, the 3 chains in the middle being dressed. Thus

for $1\frac{1}{2}$ chains from each end the plots were on *unlimed* ground, while the middle portions of 3 chains were on *limed* ground, as shown in the accompanying plan.

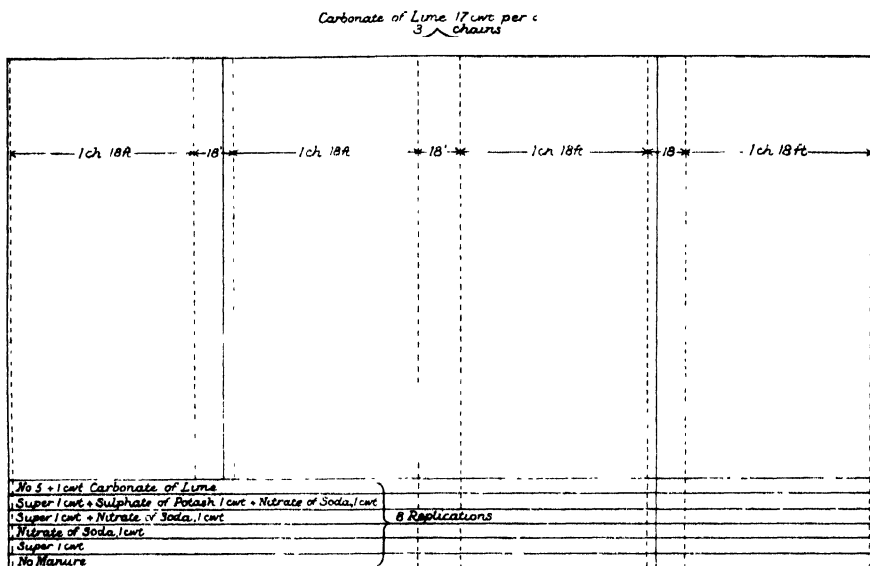


FIG. 4. PLAN OF EXPERIMENT ON R. T. MCMILLAN'S FARM (NOT TO SCALE).

Dotted lines show where crosscuts have been made to subdivide plots



FIG. 5. CUTTING THE PLOTS ON R. T. MCMILLAN'S FARM, IRWELL.

The outside divider of the reaping-machine is easily guided down the 14 in. space between the plots. The machine is driven on about 18 ft. past the end of plot, so that all material is delivered on to binding-table. The trip is then pressed and the material discharged before another plot is commenced.

[Photo by the Writer.]

Method of Harvesting.

The area was divided into four blocks by cross-subdivision. A straight cut was first of all made across the ends of the plots to ensure their being of uniform length. Then three gaps, each 18 ft. wide, were cut, so as to divide the plots into four even lengths. These sublengths were therefore (1) on unlimed ground, (2) on limed ground, (3) on limed ground, (4) on unlimed ground. The gap of 18 ft. (equal to three widths of a reaping-machine cut) enabled cutting and clearing to be done expeditiously, as follows: Starting at either end, and cutting along each seven-coulter-wide plot, the machine would continue until the gap of 18 ft. was reached and crossed. By the time the gap was crossed the whole of the material from the sublength just cut would be delivered on to the binding-table. Hence, pressing the trip and rotating the discharge-arms were all that was required to clear the machine before commencing the next sublength, and material from limed ground was kept separate from that from unlimed ground (Fig. 5).

Observations during Growth.

9th September: At the time of applying nitrate of soda a very slight superiority in appearance of the manured plots over the controls (no manure) was reported. The whole crop was particularly vigorous and healthy in appearance.

15th November: The nitrate of soda had caused an increased growth on all plots to which it was applied. The colour, too, was slightly better than on the controls and super plots, although mildew and black aphid were in evidence, more particularly on the plots which had received nitrate of soda.

Later, flag-rust made its appearance, although in other respects the crop looked an excellent one. The results are given in Table 4 (next page).

Comments on Table 4.

Critical statistical examination of results has been applied to the comparisons made between one treatment and another on limed ground, and between treatments on unlimed ground. The comparisons between limed and unlimed ground do not lend themselves to such examination, but, as will be seen, some valuable indications are given.

(a) Fertilizers compared: (a) The increases from 1 cwt. of super—about 1 bushel and $\frac{3}{4}$ bushel on unlimed and limed ground respectively—cannot be considered profitable, although their significance is established. These figures confirm those of the seasons 1923-24 and 1924-25, and it is evident that application of phosphate to the wheat crop does not pay on this farm.

(b) The appearance of the crop in the spring and early summer indicated that nitrogen was not likely to be of much avail, although its application did stimulate growth. The increase over no manure of approximately $1\frac{1}{4}$ bushels on the unlimed ground, as compared with that of about $\frac{1}{2}$ bushel on the limed ground, points to the fact that the lime has assisted nitrification and reduced the effect from the applied artificial.

Table 4.—Results of Experiment 4.
[Area of individual subplot, $\frac{1}{110.6}$ acre.]

Treatments: A compared with B.	Unlimed Ground.				Limed Ground.			
	Number of Paired Plots.	Bushels per Acre.		Difference Signi- ficant (S.) or Non- significant (N.S.).	Number of Paired Plots.	Bushels per Acre.		Difference Signi- ficant (S.) or Non- significant (N.S.).
		Yield.	Diff.			Yield.	Diff.	
A. No manure ..	16	49.14	..	..	16	51.39	..	..
B. Super, 1 cwt. ..		50.12	0.98	S.		52.11	0.72	S.
A. No manure ..	15	40.18	..	..	15	51.37	..	..
B. Nitrate of soda, 1 cwt.		50.45	1.27	N.S.*		51.60	0.32	N.S.
A. Super, 1 cwt. ..	15	50.23	..	..	14	52.30	0.22	N.S.
B. Super, 1 cwt., plus nitrate of soda, 1 cwt.		51.21	0.98	N.S.*		52.08	..	..
A. Super, 1 cwt., nitrate of soda, 1 cwt.	15	51.21	1.27	S.	14	52.07	0.05	N.S.
B. Manures "A," plus sulphate of potash, 1 cwt.		49.94	..	..		52.02	..	..
A. Super, 1 cwt, nitrate of soda, 1 cwt, sulphate of potash, 1 cwt.	16	49.88	..	..	15	51.91	0.32	N.S.
B. Manures "A," plus carbonate of lime, 1 cwt.		51.34	1.46	S.		51.59	..	..

* These increases from nitrate of soda, while not statistically significant, have chances of about 25 to 1 in their favour, and are probably real differences.

NOTE.—The differences between compared manures are shown in the "Difference" columns opposite the higher-yielding treatment of the two.

(c) Nitrate of soda applied to the super plots has behaved in much the same way as that applied to the no-manure plots (see preceding paragraph). On the limed ground the effect of the nitrogen is nil, as shown by the slight non-significant difference

(d) The addition of potash to the phosphate and nitrogen on the unlimed ground has caused a *definite* depression in yield to the extent of about $1\frac{1}{2}$ bushels per acre. Apparently the lime has neutralized this adverse effect, with the result that the mixture of phosphate, nitrogen, and potash on the limed ground has yielded practically the same as the phosphate-nitrogen combination.

(e) The final comparison shows a difference in favour of the B mixture containing 1 cwt. of lime. The small amount of lime applied with the manure has corrected the depression caused by the potash. Whether the addition of 1 cwt. lime to a mixture not containing potash would have caused an increase, or whether the lime has merely overcome

the bad effect of potash, is problematical. The following suggests that the lime would in itself have caused an increase.

(2) Unlimed compared with limed : (a) The no-manure and super plots on limed ground show increases over similar plots on unlimed ground of $2\frac{1}{4}$ and 2 bushels per acre respectively.

(b) The limed-ground increase on the plots receiving nitrate of soda alone and super plus nitrate of soda are smaller, being $1\frac{1}{4}$ bushels and about $\frac{1}{10}$ bushel respectively. The similarity in behaviour of these plots certainly supports the contention made above that the liming has encouraged nitrification and reduced the effect from the applied artificial. This is supported by the fact that on the no-manure and the super plots the limed ground shows up more favourably.

(c) The phosphate-nitrogen-potash combination on limed ground is better than that on the unlimed by just over 2 bushels per acre. If the depression due to potash on unlimed ground is subtracted from this (or added to the yield of the plot receiving potash) the figure 0.81 bushel is obtained. This is very close to the difference already shown between the super plus nitrate of soda plots on limed and unlimed ground.

(d) The last comparison between the plots on limed and unlimed ground is the only one in which the limed ground has failed to register an appreciable increase over unlimed. As already mentioned, the arrangement of the plots does not lend itself to critical examination of comparison between limed and unlimed ground. The fact that all plots, except those receiving 1 cwt. of lime, have given increases ranging from 0.87 to 2.25 bushels per acre on the limed ground is very strong evidence in favour of the beneficial effect from lime. It is hoped that further tests will be conducted in the future to settle this point.



FIG. 6. LOADING THE DRILL USED BY FIELDS DIVISION FOR SOWING CEREAL, GRAPE, AND TURNIP EXPERIMENTS.

Transport by motor-lorry enables maximum amount of work to be carried out expeditiously. The skids up which drill is pulled are carried in brackets seen on side of lorry. Pole of the drill is clamped to back of lorry to prevent movement on road.

[Photo by the Writer.]

Experiment 5 : Ashburton Experimental Farm.

In continuation of an experiment described in the *Journal* for November, 1926, page 319, in which the proprietary manure "Ammono-Phos" was tried against superphosphate and super plus sulphate of ammonia, a further trial was made in the past season, again on spring-sown wheat. Date of sowing, 19th August, 1926; date of harvesting, 11th February, 1927; variety, Solid-straw Tuscan; seeding, $1\frac{1}{2}$ bushels per acre. History of field—1925-26, potatoes; 1924-25, barley; 1923-24, fallow, following oats and vetches.

The manurial treatments were as follows :—

- (1) Control (no manure).
- (2) Superphosphate, 42/44 per cent., 104 lb.
- (3) Super, 42/44 per cent., 104 lb., plus sulphate of ammonia (20 per cent. nitrogen), 82 lb.
- (4) Ammo-Phos (20/20 grade),* 100 lb.

* NOTE.—Ammo-Phos, 20/20, contains 20 per cent. ammonia (= 16.4 per cent. nitrogen) and 20 per cent. phosphoric anhydride. Owing to the very limited area of suitable ground being available, the 13/48 grade of Ammo-Phos used in the previous year had to be omitted from the present experiment.

Observations during growth : Soon after coming through the ground all manured plots showed a marked and equal superiority in growth over control. The plots receiving nitrogen, although not noticeably better in growth than the super plot, showed a much deeper green colour than the latter, which by comparison looked decidedly yellowish.

The results are shown in the following table :—

Table 5.—Results of Experiment 5.

[Plots repeated 25 times. Area of individual plot, $\frac{1}{87.5}$ acre.]

Treatments. A compared with B.	Number of Paired Plots.	Bushels per Acre.		Difference Significant (S.) or Non-significant (N.S.).
		Yield.	Difference in Favour of A.	
A. Super, 104 lb. }	25 {	45.3	3.3	S.
B. Control }		42.0	..	..
A. Super, 104 lb., and sulphate of ammonia, 82 lb.]	25 {	48.5	3.2	S.
B. Super, 104 lb. }		45.3	..	..
A. Ammo-Phos (20/20), 100 lb. .. }	25 {	48.9	0.4	N.S.
B. Super, 104 lb., and sulphate of ammonia, 82 lb. }		48.5	..	..

Comments on Table 5.

(1) The increase of nearly $3\frac{1}{2}$ bushels per acre due to super is quite paying, leaving a net profit of about 11s. per acre. In the preceding year super did not give any increase.

(2) The super and sulphate of ammonia combination has proved better than super by 3.2 bushels per acre. This increase, due to the sulphate of ammonia, while considerable, only just pays for the nitrogen addition. In the preceding year the same amount of sulphate of ammonia caused an increase of $5\frac{1}{2}$ bushels per acre.

(3) Ammo-Phos and the mixture of super and sulphate of ammonia, both of which contain the same amount of fertilizing constituents per acre, show no significant difference in yield. In the 1925-26 season the mixture proved better than the Ammo-Phos by $\frac{1}{4}$ bushel per acre.

General Conclusions.

(1) With the exception of the Irwell experiments, readily available phosphates continue to give profitable returns when used at 1 cwt. per acre.

(2) In the districts under review there is no encouragement to use a greater quantity than 1 cwt. per acre with the wheat crop.

(3) Potash, so far as its trial has progressed, is in the main useless, and in some cases worse than useless in that it has depressed yield.

(4) Nitrogen in the soluble form of nitrate of soda or sulphate of ammonia has given sufficiently good results to warrant its trial on crops which tend to be backward in growth and of poor colour in the spring. It should not be applied before the middle of September. More experimental evidence is required before its general use on backward crops can be recommended.

The continued co-operation of the farmers named is sufficient evidence that their assistance and interest are appreciated by the Department, and that the Department's work is appreciated by them. For the carrying-out of much of the field-work and the tedious working out of results thanks are due to Messrs. Calder, Bates, Bryden, and Hardy, of the Fields Division staff in Canterbury.

FARMING OF "BUSH-SICK" COUNTRY.

THE position with regard to bush-sickness or soil-deficiency disease in the affected North Island district is stated by the Director of the Live-stock Division (Mr. J. Lyons) in his annual report for 1926-27 as follows —

"That a considerable improvement has been effected on many of the farms within the bush-sick area is apparent to any one familiar with the district during the past decade. On many of the farms dairying is being carried on with reasonable hope of ultimate success, where a few years ago it was impossible to carry stock of any description successfully. A good example of this is to be seen in our own experimental farm at Mamaku. During the past few seasons dairying has been carried on with increasing success. From a herd of some twenty-odd cows milked during the past year the returns were good, and the animals maintained their health throughout the season. In fact, their yield and condition were in excess of that hoped for by those knowing the district a few years ago. The altered conditions have been brought about simply by better farming methods—viz., laying down good pastures, suitable top-dressing, frequent changes, and growing roots and hay for winter feed. Notwithstanding the knowledge we have acquired, this is difficult country for the average settler to bring into a satisfactory state of cultivation. The success of the venture depends to a great extent on the amount of capital at his disposal. A larger amount is required than for outside country, and the average man going on the land has not the necessary finance. The result is a continued struggle, with the not infrequent result in the past that the settler has had to abandon his land.

"The value of citrate of ammonia and iron as a curative agent in this trouble has been demonstrated during the past season. Large quantities have been sold at cost price, and there is still a good demand for it by settlers in the affected areas."

FARMERS' FIELD-CROP COMPETITIONS.

TARANAKI-WANGANUI DISTRICTS, SEASON 1926-27.

J. W. DEEM, Instructor in Agriculture, Wanganui.

FARMERS' field-crop competitions were carried out in fifteen centres of the Taranaki-Wanganui districts during last season, against twelve in 1925-26. Although there were more centres competing, the crops actually judged were somewhat fewer, the numbers being 231, against 254 in the preceding year, a decrease of twenty-three. The crops consisted of the following: Mangolds, ninety; carrots, sixty-one; swedes, forty-nine; turnips, nine; lucerne, sixteen; and chou moellier, six. In addition to these, three ensilage-judging competitions were held, a total of thirty-seven stacks and pits being judged. The lucerne and soft turnips were judged in February, and the mangolds, carrots, swedes, and ensilage between 20th May and the middle of July. A very fine exhibit was again staged at the Hawera Winter Show.

As pointed out in previous reports, these competitions have a valuable educative value for those who care to follow them up. The results from year to year clearly demonstrate the best methods of cultivation, the best varieties to grow, weight of seeding, manures to use, &c. From the instructional staff's standpoint, moreover, nothing could afford a better opportunity of keeping in touch with the farmers and agricultural methods of the district.

Mangolds.

Sowing operations were greatly delayed owing to very unseasonable weather, and many farmers had to resow. This made them late, and it was thought that the average crops would be considerably lighter than usual. However, the judging returns show an average of 59 tons 13 cwt., against 59 tons 14 cwt. last year, which is very close. The good results obtained under very adverse conditions must be attributed to better methods of cultivation, &c.

Varieties.

Prizewinner Yellow Globe still holds pride of place, although some very fine crops of Orange Globe were also judged. This latter is a very good cropper, but has a heavy top that is hard to cut or break off, and the root is slow in ripening. The placings of the varieties in the fifteen competitions were as follows: Prizewinner Yellow Globe, eleven firsts, nine seconds, nine thirds; Giant Orange Globe, three firsts, two seconds, two thirds; Yellow Globe, one first; mixed varieties, two seconds, one third; Jersey Queen, one second, one third; Long Red, one third. The averages were: Prizewinner, fifty-six crops, 61 tons 6 cwt.; Giant Orange Globe, sixteen crops, 65 tons 17 cwt.; Long Red, three crops, 41 tons 2 cwt.; Jersey Queen, four crops, 53 tons 15 cwt.; mixed varieties, nine crops, 55 tons 8 cwt. Red Intermediate is a mangold that has done well right through South Taranaki in connection with boys' and girls' clubs, and will probably figure among the competitions next year.

Championship Crops.

Particulars of the championship crops winning the Sutton Cups in their respective districts are as follows:—

Wanganui: W. Stephenson, Maxwelltown—Prizewinner Yellow Globe, grown after carrots; yield, 71 tons 5 cwt. per acre; sown 14th November in drills 26 in. apart; manure, super 5 cwt.; seed, 6 lb. per acre. Mangolds were lighter in this district than in the preceding year, the average being 55 tons 10½ cwt., against 59 tons 18 cwt.

South Taranaki: H. Betts, sen., Okaiawa—Area, ½ acre; Giant Orange Globe, after lucerne; sown in October in garden, and transplanted first week in November in drills 18 in. apart; mangold-manure, 2 cwt., and kainit, 2 cwt., per acre, plus some stockyard manure over a portion of the field; yield, 128 tons 19 cwt. Full marks were given for cultivation. It is interesting to note that this crop was transplanted, and that practically the whole of the work was done by Mr. Betts, who is in his ninety-first year.

North Taranaki: J. B. Hine, Toko—½ acre; Prizewinner Yellow Globe; yield, 90 tons 11 cwt.; sown 2nd November; seed, 6 lb.; drills, 18 in.; manure, 7 cwt. super and 5 cwt. salt per acre; mangolds following mangolds. This is the third crop of mangolds grown on this area in succession. The weights of the respective years are as follows: 1925, 89 tons 7 cwt.; 1926, 111 tons 13 cwt., and 1927, 90 tons 11 cwt. This area was originally a holding-paddock near the cow-shed, and no doubt received a lot of cow-manure. As a general practice the growing of mangolds on the same land for several years is not recommended, but many cases have come under notice where very fine crops have been grown for several years in succession.

Another very fine crop was that grown by Mr. C. Willis, Matapu: Orange Globe, 96 tons 1 cwt., grown in 18 in. drills, with 5 cwt. mangold-manure. Mr. Willis has won the Sutton Cup for South Taranaki twice, and was runner-up this year.

Width of Drills and Amount of Seed per Acre.

The findings under this heading last year are borne out by this year's results—namely, that drills 21 in. to 25 in. apart, and seed 5 lb. to 7 lb. per acre, give on the average the best results. It is true that the heaviest crops this year were grown in 18 in. drills, and if the grower has time to do all the work by hand, and does it properly, he will get a wonderful crop under these conditions. The wider drills allow of a great deal of the work being done by the horse-hoe.

Manures.

This year's results again demonstrate the fact that any good phosphatic-manure mixture, provided it has a fair amount of super and is applied in reasonable quantities, will give good results, particularly if supported with from 3 cwt. to 5 cwt. of salt or kainit. It will be noticed from Table 1 that eight crops which had 6 cwt. phosphates plus 3 cwt. salt per acre gave an average of 65 tons 4 cwt., being 5 tons 11 cwt. above the average for all crops; while eleven crops that had

4 cwt. phosphates plus 3 cwt. kainit averaged 64 tons 1 cwt., or 4 tons 8 cwt. above the average. Had the kainit-manured crops been supplied with the same amount of phosphates it is probable that they would have given a better average than those which received salt; but both returns go to show the advantage of using either salt or kainit.

Table 1.

Number of Crops.	Manure.					Average Weight of Manure per Acre.	Weight of Crop per Acre.
						Cwt.	T. cwt.
2	Basic super	..	..	..	..	5	68 18
2	Basic super	..	..	..	..	5	71 0
	Kainit	..	..	..	..	5	
7	Super and bone	..	..	..	..	5	55 0
12	Super and bone	..	..	..	..	5	54 0
	Potash salts	..	..	..	..	1	
37	Proprietary manures	..	..	..	..	5	58 2
8	Mixed phosphates	..	..	..	..	6	65 0
	Salt	..	..	..	..	3	
11	Mixed phosphates	..	..	..	..	4	64 1
	Kainit	..	..	..	..	3	
8	Super	..	..	..	..	4	60 11

The mixed phosphates were mostly made up as follows: 3 parts super, 1 part bonemeal, and 1 part Nauru rock phosphate, or 3 parts super and 2 parts bonemeal or Nauru.

The following table gives particulars of the best twelve crops:—

Table 2.—Twelve Best Crops of Mangolds.

Variety.	Yield per Acre.	Date sown.	Width of Drills.	Amount of Seed	Weight of Manure.	Particulars of Manure	Remarks.
Orange Globe	T. cwt. 128 19	1/11/26	18	lb. trans- planted	Cwt. 4	2 cwt. mangold-manure, 2 cwt. kainit, plus cowyard manure	After lucerne.
Orange Globe	96 1	2/11/26	18	4	5	Proprietary manure ..	After grass, ploughed twice.
Prizewinner	90 11	2/11/26	18	6	12	7 cwt. super, 5 cwt. salt	After two crops of mangolds
Prizewinner	86 11	25/10/26	21	6	8½	3 cwt. super, 1 cwt. bone, 1 cwt. Nauru, ½ cwt. potash, 3 cwt. hide salt	Lea land, ploughed in August.
Prizewinner	80 17	12/11/26	21	6	4	Proprietary manure ..	After swedes.
Prizewinner	79 13	28/10/26	28	6	5	2 cwt. bone, 2 cwt. super, 1 cwt. sulphate of potash	After green oats.
Orange Globe	77 15	28/10/26	24	7	4	Mangold-manure ..	After swedes.
Prizewinner	74 15	18/11/26	22	8	8	Bone, super, slag, and sulphate of potash	After mangolds.
Prizewinner	74 14	18/10/26	21	4	4	Basic super ..	After barley.
Prizewinner	74 12	12/11/26	21	4½	9	4 cwt. basic super, 5 cwt. kainit	After swedes.
Prizewinner	73 4	28/11/26	21	5	7	5 cwt. super, 1 cwt. bone, 1 cwt. 30-per-cent. potash	Lea land, ploughed once.
Prizewinner	71 12	24/11/26	18	5	5½	2 cwt. bone, 1½ cwt. super, 1½ cwt. Nauru, ½ cwt. sulphate of potash	Lea land, ploughed once.

Carrots.

Difficulty was experienced in getting a strike with early-sown crops, but after they got a start they did well. Sixty-one crops were judged, against fifty-seven last year. The average weight was 45 tons 8 cwt., as compared with 44 tons 12 cwt. last year. A number of varieties were judged, but first place is again taken by Matchless White. This variety is bad for bolting to seed, but even with this fault it seems to give the best all-round crops for pulling and feeding out. Guerande was seen only in the Maxwelltown district, where considerable areas are grown for sheep. This carrot weighs out well, and should be more generally grown for sheep-feeding. It is, of course, excellent for cows, but takes a lot of handling when being pulled and carted out. Following are some particulars of crop yields: Twenty-seven Matchless White averaged 47 tons 14 cwt.; five Sinclair's Champion, 46 tons 10 cwt.; three Barriball, 47 tons 9 cwt.; three Guerande, 56 tons 9 cwt.; three Yellow Intermediate, 38 tons 15 cwt.; two White Belgian, 47 tons; two Magnum Bonum, 44 tons 4 cwt.; fifteen mixed varieties, 40 tons 15 cwt. Of the eleven competitions judged, Matchless White won eight firsts, four seconds, and six thirds; Sinclair's Champion, two firsts, one second, and two thirds; Yellow Intermediate, one first and one second; Guerande, one first and one second; mixed varieties, one second and two thirds. The poor showing of the mixed varieties was no doubt due to inferior seed. Generally these carrots would be sown as a definite variety, but when pulled were found to contain several varieties of inferior quality. There is far too much of this inferior carrot-seed on the market. The next table gives particulars of the best twelve crops.

Table 3.—Twelve Best Crops of Carrots.

Variety	Yield. per Acre.	Date sown.	Width of Drills.	Amount of Seed.	Weight of Manure	Particulars of Manure	Remarks.
Matchless White	T cwt.		In.	lb.	Cwt.		
Matchless White	68 1	14/11/26	24	1½	4	Mangold-manure	After grass
Matchless White	66 6	12/11/26	16	1	3	Carrot-manure	After oats.
Matchless White	64 7	19/11/26	22	1	8	Bone, super, slag, and 30-per-cent potash, equal parts	After mangolds.
Guerande	62 3	10/11/26	24	1½	4	Mangold-manure	After swedes
Matchless White	61 2	12/11/26	14	2	4	Carrot-manure	After soft turuips.
Guerande	59 2	2/11/26	14	1½	2	Super	After lea, ploughed once
Barriball	58 7	13/11/26	14	1	4	Carrot manure	After swedes
Sinclair's Cham- pion	55 1	2/12/26	14	½	2	Super	After lea, ploughed once.
Matchless White	54 10	1/11/26	24	3	4½	Super	After potatoes
White Belgian	53 14	1/11/26	24	3	4½	Super	After potatoes.
Matchless White	51 17	20/11/26	16	1	5	Super, blood and bone, salt, and potash	After grass, ploughed in September
Matchless White	51 10	17/11/26	14	2	3	Carrot-manure	Lea land, ploughed once

There is a considerable variation in date of sowing, but it appears safe to say that the best time for the larger varieties is between the last week of October and the middle of November, using from 1 lb. to 1½ lb. of seed per acre. Guerande carrots should not be sown so early unless required for early autumn feed, as they mature quicker; the best time is from the middle to the end of November, but many

good crops have been sown as late as the middle of December. These carrots are best sown on ridges 21 in. apart, at the rate of $1\frac{1}{2}$ lb. of seed, and given intercultivation, but not thinned.

Manures.

These again show a wide variation, but it would appear that any good phosphate manure or mixture of phosphate and potash, used at from 3 cwt. to 5 cwt. per acre, is suitable for carrots. Unless sowing with a ridger, which puts some of the manure well down, it is found advisable to broadcast half of the manure just before the last harrowing and apply the remainder with the seed. If too much manure is sown near the surface with carrots there is a tendency for them to fork. The rates of manuring are interesting: Five crops which received 2 cwt manure averaged 42 tons 6 cwt. in yield; seventeen crops at 3 cwt., 43 tons 9 cwt.; twenty-one at 4 cwt., 47 tons 11 cwt.; five at 5 cwt., 44 tons; two at 6 cwt., 49 tons 14 cwt.; two at 8 cwt., 34 tons 3 cwt.; and one at 9 cwt., 46 tons 14 cwt.

Swedes.

More farmers grew swedes than for some years past, and, on the whole, quite good crops were secured. A considerable number of crops were more or less affected with club-root. The decrease in the number of crops affected with dry-rot was maintained this year, and, with the exception of a few crops about Otakeho, very little of the disease was found. The average weight of crops judged this year was 44 tons 5 cwt., compared with 41 tons 6 cwt. last year. Now that dry-rot is not so prevalent the old favourite, Superlative, is being more extensively grown. In nine competitions Superlative gained three firsts, Masterpiece two, Magnum Bonum two, Grandmaster one, and Monarch one. The general weights of manure ran from 2 cwt. to 4 cwt. per acre; ten crops receiving 2 cwt. averaged 41 tons 17 cwt.,

Table 4. -Ten Best Crops of Swedes.

Va-ri-ety	Yield per Acre.	Date sown.	Width of Drills	Amount of Seed.	Weight of Manure.	Particulars of Manure.	Remarks.
Masterpiece	T. cwt. 64 2	19/12/26	14	Oz. 14	Cwt. $1\frac{1}{2}$	Half super, half bone	After grass, ploughed in October.
Superlative	61 17	10/12/26	7	9	4 $\frac{1}{2}$	$1\frac{1}{2}$ cwt. super, $1\frac{1}{2}$ cwt. slag, 1 cwt. bone, and $\frac{1}{2}$ cwt. sulphate of potash	After grass, ploughed once.
Superlative	54 12	10/12/26	7	14	3	Half super, half bone ..	After grass, ploughed in September.
Superlative	54 11	21/12/26	14	9	3	Basic super ..	After grass, first ploughing.
Crimson King	53 16	24/12/26	7	14	4 $\frac{1}{2}$	Third each slag, super, and bone, plus 20 lb. sulphate of potash	After grass, ploughed in November.
Masterpiece	51 14	20/12/26	14	15	3	Basic super ..	Lea, ploughed once.
Superlative	51 10	22/12/26	14	9	2 $\frac{1}{2}$	Basic super ..	Virgin land, ploughed in November.
Superlative	50 5	18/12/26	7	16	3	Basic super ..	After grass, ploughed in August.
Monarch	49 9	25/11/26	14	10	3 $\frac{1}{2}$	$1\frac{1}{2}$ cwt. super, $1\frac{1}{2}$ cwt. bone, $\frac{1}{2}$ cwt. sulphate of potash	After grass, ploughed in October.
Grandmaster	49 6	14/12/26	7	10	4	Turnip-manure ..	After grass, ploughed in October.

twenty-nine which had 3 cwt. averaged 43 tons 1 cwt., and nine at 4 cwt., 48 tons 13 cwt. Four crops fertilized with bone and super averaged 51 tons 2 cwt.; seven with basic super, 47 tons 3 cwt.; twenty-one with proprietary manure, 42 tons 3 cwt.; six with super, 39 tons 4 cwt.; and four with super, bone, and potash, 42 tons 8 cwt. The addition of potash does not appear to have increased the weight of the crops, but it may have slightly improved the feeding-value.

Table 4 gives particulars of the ten best crops.

Soft Turnips.

There was only one competition in soft turnips during the season under review, and the average crop was 36 tons 6 cwt., against 36 tons last year.

Lucerne.

Only two competitions in lucerne were conducted, sixteen crops being judged. The wet weather about Christmas, followed by a sudden dry snap, rather upset some growers' calculations; consequently many of the crops were in a very uneven stage of growth at judging-time, and in these cases the competitions were not gone on with. The crops judged were very good on the whole. A few crops that were very dirty last year, and created doubts as to their ultimate success, showed a wonderful improvement, giving a splendid demonstration of what can be done by careful treatment.

In last year's report (*Journal* for September, 1926) I mentioned J. Clague's fine crop of lucerne. This crop won again in the Manaia competitions, scoring 48 out of a possible 50 points, against 49 last year. The treatment given in the interval, apart from cultivation, was a top-dressing with 3 cwt. of super per acre. The 8-acre field on the Waimate West Demonstration Farm scored 46 points, against 48½ last year. The drop in points was owing to unevenness and coarseness in a portion of the area which is in wide drills.

Chou Moellier.

There were two small competitions with this fodder during the past season, and only six crops were weighed and judged. The winner of the Toko competition, G. Cook, had a very nice crop which yielded 33 tons 15 cwt. per acre. The six crops averaged 26 tons 8½ cwt., and as they were fair average crops it may be accepted that a fair crop of chou moellier weighs between 26 and 30 tons.

Ensilage.

The making of ensilage has come very much to the fore in Taranaki during the last three or four years, and in some districts fully 90 per cent. of the farmers adopt this means to supply part or whole of their supplementary fodder. The usual method of saving is by the stack, but there are a good many pits and a few silos. This year the three districts holding judging competitions provided farmers with a good opportunity of observing different methods of saving, and altogether a very interesting and educative time was spent and some excellent ensilage seen.

The judging was done on points as follows: A maximum of 50 for uniformity and quality, 25 for minimum waste, 20 for covering, and 5 for site, making a total of 100 points. The ensilage is judged in the stack or pit, it being a condition that all material must have been cut so as to expose a face. These competitions are likely to become very popular, and already arrangements have been made to hold several more next year. Table 5 gives particulars of the three first placings in each competition.

Table 5.

Name of Competitor.	Uniformity and Quality.	Minimum Waste.	Covering.	Site.	Total.	Remarks.
Lepperton (9 entries).						
H. E. Blyde ..	42	22	18	3	85	Round pit; grass and oats.
H. Wallace ..	43	20	15	4	82	Round stack; grass.
D. B. McKee..	41	22	14	4	81	Square pit; grass.
Tikorangi (15 entries).						
J. Paulger ..	42	20	16	5	83	Square stack; grass.
F. Blyde ..	43	19	15	5	82	" "
N. L. Sarten ..	42	17	14	5	78	" "
Tokaora (13 entries).						
H. Batten ..	42	24	20	5	91	Concrete silo; lucerne.
N. Wren ..	43	20	18	5	86	Round pit; grass.
H. Wren ..	43	19	17	5	84	" "
J. A. McCallum	41	18	14	5	78	Square pit, lucerne.

Although Mr. Batten entered his silo and had it judged, he generously withdrew it from the competition in so far as the prizes were concerned, recognizing that it was too big a handicap for farmers with stack or pits to compete against a properly constructed silo.

In conclusion, I should like to express my appreciation of the work done by Messrs. A. J. Glasson and J. M. Smith, Instructors in Agriculture, who were associated with me in judging several of the competitions.

Compensation for Condemned Stock and Meat.—For the financial year of 1926-27 the Department of Agriculture paid out compensation totalling £15,715 on 5,199 animals condemned in the field for diseases under the Stock Act, and £13,963 for carcasses or parts of carcasses condemned at abattoirs and meat-export works, under the Slaughtering and Inspection Act. The aggregate of these amounts represents a decrease of £1,205 compared with the figures for 1925-26.

Casein-manufacture.—In connection with the last dairying season the Director of the Dairy Division remarks that the quality of casein continued of a uniformly high standard. Rennet casein commands a high market value, being particularly low in butterfat content. Quantities manufactured for export show a slight increase over the preceding year of 14½ tons, the figures being 1,613½ tons lactic and 151 tons rennet casein, as against 1,126 tons lactic and 624 tons rennet.

SEASONAL NOTES.

THE FARM.

PASTURE-MANAGEMENT AND THE FEEDING OF STOCK.

THE appearance of abundant rank grass in pastures at the end of November is frequently followed by a sharp drop in milk-yield by dairy cows and a check in the growth of lambs. It is the short pasture grass about 4 in. high that is really efficient as a milk-producer. The fall in milk-yield is due to the fact that rank grass is not so nutritious as short grass. Close subdivision and rotational grazing will help to prevent the grass getting unduly long. On dairy farms the mower should always be used to clear off any surplus rank growth. If the growth is heavy it can be made into hay or ensilage, or, if light, left in the field and the young dry stock on the farm turned in to eat it up as soon as it is wilted. On many farms the mowing of the rank growth is left rather late, not being done till January or February. Early mowing is important, because the autumn growth of grass is thereby increased. In the case of breeding-ewes, cattle are necessary to keep the pastures short enough for the ewes and lambs. Young growing cattle are usually the best for keeping rank growth down. Mature fattening bullocks require the best grass if they are to fatten quickly. The popularity of dairy heifers as the main type of cattle-beast carried on many fat-lamb-raising farms is that the young growing animals can be made to eat rank grass more readily than fattening animals. Too much grazing of rank pasture grass, however, is not good for young growing cattle, especially dairy heifers, as they require protein-rich fodder just as much as milking-cows or growing lambs.

LUCERNE.

Established stands of lucerne are generally ready for the first cutting some time in November. It is unwise to cut too early, as this usually reduces the weight and number of subsequent cuts. Flowering is frequently late in the spring, and the stage to cut is often determined by the appearance of fresh buds at the base of the crown. As the weather is often unsettled in November the first cut of lucerne on dairy farms is preferably made into ensilage. For this purpose it should be stacked along with grass from early-mown pastures. This is usually necessary because on most farms insufficient material is available from the lucerne-field alone to make a satisfactory stack, and also because the quality of the silage is better when lucerne is mixed with grass.

November is usually the best month to sow new stands of lucerne. The success or otherwise of a stand of lucerne depends on many circumstances, but the main factors are the soil-conditions and the climate. Lucerne naturally does best in a warm, dry climate and a deep alluvial soil well supplied with moisture in the deeper layers. As a fodder plant its successful cultivation on a large scale is restricted to districts where the summer climate is warm and dry, the winter not too severe, and the soil fertile and deep. Its culture in England, for example, has

extended over several hundred years, but it is only grown at all largely in the two driest counties, Essex and Kent. Its use in the United States is mainly in the low-rainfall areas in the western half of the country. It has been grown and experimented with in all parts of New Zealand with more or less success, but it is only extensively cultivated in Marlborough and the low-rainfall districts of Otago. In a wet climate it has to contend against the competition of grass and clover, which in many parts of the North Island take possession of the land during the winter and early spring when the lucerne is dormant. A small area of lucerne is a very valuable permanent fodder crop on many North Island dairy farms, but in selecting the site for the sowing of any new areas great care should be exercised to see that the land chosen is well drained in the winter. Success in growing lucerne in many parts of the North Island has been much more marked since the adoption of the practice of regularly top-dressing the stand with phosphatic fertilizers, and so keeping the plants in a vigorous condition.

The seed-bed for lucerne should be carefully prepared. The crop frequently does best after grass, but care should be taken to see that the land is free from twitch. The land should be ploughed in the late winter or early spring so as to allow plenty of time for the grass to rot. Lime is generally applied at the last cultivation and disked in. The seed-bed should be fine and firm, and rolled before drilling. Colonial or Hunter River seed is usually the most satisfactory. The quantity of seed sown depends on the climate and the method of sowing. In the drier parts of the South Island 10 lb. to 14 lb. for broadcast or drilling in 7 in. rows for 14 in. or 21 in. rows 10 lb. or 8 lb. is usually enough; in the wetter districts 15 lb. to 18 lb. is usually sown. Inoculation should be carried out either by mixing the seed with inoculated soil or by broadcasting 2 cwt. to 3 cwt. of inoculated soil over the field on a dull day before drilling, and disking it in. If inoculated soil cannot be economically obtained the proprietary culture known as Farmogerm may be used on the seed. In practically all cases phosphatic fertilizers should be sown with the seed, 2 cwt. to 3 cwt. of superphosphate being the standard application.

Many promising stands of lucerne have been ruined by too early cutting in the first year. The first cutting should not take place till the young plants are blooming and fresh buds have appeared at the base of the plant. Cutting before this stage is reached greatly weakens the vigour of the young plants.

ROOT CROPS.

The main sowings of soft turnips, Aberdeen turnips, and swedes take place in November. No general rule for time of sowing can be laid down, as conditions vary so greatly in different districts. In Canterbury the attacks of the grass-beetle on the newly germinated plants is often serious with November sowings. The root-crop competitions, where they have been carried out for a number of years, have given very valuable information as to the best time for sowing in particular localities. In many districts carrots and mangolds are not sown till November, and in any year when October is wet and cold it is usually best to delay sowing till the late period.

GREEN FORAGE CROPS AND CATTLE-PUMPKINS

The main sowings of rape, kale, chou moellier, millet, and maize for green fodder should be made during November. Mustard or Italian rye-grass should be sown with the rape; with mustard it is best sown after the rape is up in two rough leaves, so that both crops may mature together. Japanese millet should not be sown too early; any time after the middle of November in the warmer localities, and the first week in December in the colder districts, is quite soon enough.

Cattle-pumpkins are a valuable supplementary feed for the late autumn and early winter on many North Island dairy farms. The crop is preferably cultivated near the milking-shed, so that the accumulated yard manure can be used for fertilizing the plants. Although the crop can be successfully grown without yard manure, the yield is greatly increased by its use. Holes should be made about 10 ft. apart, a barrow-load of manure dug in and well incorporated with the soil, and three or four seeds planted above it. Generally speaking, the crop will not keep beyond the end of June.

TEMPORARY AND SHORT-ROTATION PASTURES.

In many parts of the South Island kale is being grown to replace swedes and turnips for late winter and early spring feeding. Most years, however, the land for kale is not ready for ploughing till September or October, and the land can often be more profitably sown in a temporary pasture of Italian rye-grass, or Italian rye-grass and red clover, after it is broken up. A temporary pasture sown in November throws a very large amount of autumn feed of high palatability. The provision of a temporary pasture of this nature will reduce the amount of cereal catch-cropping necessary for autumn feed, and will also provide good winter and early spring feed.

Large areas of short-rotation grassland in Canterbury are usually sown down with rape in November. This provides for cheap establishment of the grassland, and prevents the young pasture being destroyed by the grass-grub, but on light land often results in an indifferent pasture in dry years.

- P. W. Smallfield, *Instructor in Agriculture, Ruakura.*

THE ORCHARD.

SPRAYING.

THE majority of apple-trees will now be blossoming, a stage at which, as far as possible, trees should not be sprayed. Weather conditions are often favourable for the development of black-spot about this time; consequently it is advisable to spray again as soon as about 75 per cent. of the blossoms have fallen, or at what is termed the petal-fall or calyx stage.

From now on till the fruit-set stage is a critical time, and careful consideration must be given if the best results are to be obtained. In some districts, and with some varieties, dropping of fruit is bad, while black-spot is liable to put in an appearance at any time. At the calyx period it has been found beneficial to spray with either a combination

of lime-sulphur and one of the sulphur pastes, or with a sulphur paste alone, according to variety. If the weather conditions are favourable, and there is no black-spot in evidence, a sulphur paste at strength of 6 lb. to 8 lb. per 100 gallons of water on the more tender varieties, such as Dunn's and Cox's Orange, will do much to prevent dropping. This spray, although not as good a fungicide as lime-sulphur, appears to act as a tonic to the tree, especially in cases where lime-sulphur has been used three or four times up to the calyx period. On the other hand, if the weather conditions are favourable for the development of black-spot, it is advisable to use lime-sulphur at strength 1-100 with the addition of about 4 lb. of sulphur paste. The addition of the paste will help to prevent dropping, while the lime-sulphur will prevent the germination of any spores of black-spot that may be about. Where a grower is only considering the prevention of black-spot and not the export of fruit, bordeaux at strength of 3-4-50 can be used. This spray may possibly check black-spot more than lime-sulphur, but the fruit will be considerably russeted.

Up to the present black-spot has mainly occupied attention, but from this stage onward the various pests of the orchard will have to be considered. Fortunately, some of them--red mite, leaf-hopper, &c.—can be kept in check with lime-sulphur, but the control of others, such as codlin-moth and leaf-roller caterpillar, requires a poisonous spray. Some orchardists are of the opinion that the combination of lime-sulphur with arsenate of lead is the cause of much burning of foliage and dropping of fruit. No doubt the best procedure is to spray separately, and if time can be found this practice is to be recommended, but where a large area has to be dealt with it is often found impossible to carry out separate sprayings. The addition of milk of lime (from 2 lb. of fresh lime per 100 gallons of spray) to neutralize any free arsenic will help considerably to minimize the chance of burning. The extra amount of arsenate of lead used by some growers may be the cause of much burning, and is not to be recommended. If the spraying is done thoroughly the quantity of lead advised is quite sufficient to cope with any attacks from codlin-moth. Lime-sulphur at strength 1 in 100-120, plus arsenate of lead 1½ lb. to 2 lb. powder or 3 lb. paste, plus 4 lb. sulphur paste per 100 gallons, plus milk of lime from 2 lb. fresh lime, sprayed at the fruit-set period, will prove satisfactory in coping with black-spot, red mite, codlin-moth, and leaf-hopper. The addition of a spreader is advised with all sprays, but more especially when the foliage is on the trees.

Another spraying of pears with bordeaux at strength 3-4-40, or lime-sulphur 1-100-120, plus arsenate of lead, is recommended for the control of black-spot and codlin-moth.

About three weeks after the fruit is formed stone-fruits should receive another dressing of lime-sulphur 1-120, plus 3 lb. to 4 lb. of sulphur paste, for the control of brown-rot. It is also advisable to go carefully over the trees, thinning out and destroying any fruits affected with brown-rot. This will help to prevent the spread of the disease to healthy fruits.

CULTIVATION AND MANURING.

Cultivation of the orchard when the fruit-trees are being taxed to the utmost at the fruit-setting period is most important. To lose soil-moisture at this time of the year is often disastrous. Retain this

moisture by the constant use of the disks and harrows. After the soil is well worked down it is only necessary to stir it to a depth of from 3 in. to 4 in., keeping it loose, so as to allow free access of air into the soil. If possible, harrow the orchard after rains in order to prevent the formation of a crust.

Although the season is advancing, good results may still be obtained from the application of manures, especially potash and nitrates. These fertilizers can either be spread round the trees or broadcast and harrowed in.

DISBUDDING, GRAFTS, ETC.

Trees planted during the winter months need attention as soon as they start into growth in the spring. Select three or four good well-placed shoots for the future framework of the tree, and suppress the remainder.

Examine grafts, loosening any ties where necessary to prevent damage as the scion grows. The old method of suppressing all shoots from the stock is now not advocated. Pinch back where necessary, leaving others in suitable positions for budding or grafting next season should any of the present grafts fail. If not required these can be pinched back later in the season. Where there is any danger of the new scions being broken off by wind it is advisable to protect them by tying to a stake attached to the branch grafted.

—G. Stratford, Orchard Instructor, Motueka.

Citrus - culture.

With renewed activity of the trees, cultivation becomes the chief work in the citrus-grove. Where for any reason ploughing has not been done, but is now being attended to, the land should be worked down to a fine tilth as soon as possible after being broken up, it being a good practice not to turn up more than can be worked down during the same day. This is advisable owing to the risk of the turned-up clods becoming dry and so hard as to be almost unbreakable later.

In the case of land that has been previously ploughed periodical working with the cultivator should be done to secure a fine condition of the top soil as early in the season as possible. There is an impression current that because citrus-trees are so prone to make surface roots cultivation near the trees is inadvisable or even injurious. It is true that citrus-trees are all very prone to form a mass of fibrous roots near the surface, but it does not necessarily follow that these are of importance to the tree or should be encouraged. Rather the contrary applies; in fact, such roots should be discouraged, except where it is possible to apply a summer surface mulch of decayed manure or litter. Under a system of clean cultivation it is better to keep the surface soil constantly worked for at least 5 in. deep, thus preventing the formation of surface roots, and encouraging the roots at a lower level, where they are less susceptible to acute changes of temperature and moisture.

With a general extension of growth in the trees a limited amount of pruning should be done, mainly along the lines of preventing undue crowding or extension of new growth.

A soil-dressing of 1 lb. to 2 lb. of nitrate of soda, according to size of tree, should be given to oranges during or immediately after flowering. Application to lemons can be made later as they attain the fruit-set stage.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

LATE-HATCHED CHICKENS.

POULTRY-KEEPERS who have managed things well will have their full complement of chickens hatched out by the end of the present month. In a general way a chicken brought out later than this is starting its life under a big handicap as compared with the bird hatched earlier in the season. Some amends, however, may be made with late-hatched birds if they are placed under the most favourable conditions possible. The first essential is that they be provided with a clean piece of ground to run on, while shade from hot sun and shelter from winds are of equal importance. The food should not only be supplied with a liberal hand, but also be nourishing and palatable. Succulent green material cannot be oversupplied, while grit and clean water should always be within reach of the birds. Where skim-milk is available it can be given in large quantities to drink. The value of skim-milk for bringing on late-hatched chickens, or, indeed, chickens whenever hatched, can hardly be overstated. Further, if the young birds are to thrive and make rapid growth it is important that they be provided with clean quarters and protected from insect pests in every way.

AGE OF EGGS FOR INCUBATING.

A correspondent asks, If more or less stale eggs were placed in an incubator with fresh eggs, which of the two would hatch out first, and which would be the most likely to produce the strongest chicks? In a general way eggs that are from one to five days old will hatch out about the same time, and the quality of the chicks in all respects will be more or less equal. After this period the older the eggs become, the longer will it take to hatch them, and the smaller and more difficult will the chicks be to rear. It is quite possible to secure chicks from eggs that have been laid a month or even longer, but generally such eggs will take at least twenty-four hours longer to hatch than those that are fresh, while the chicks are seldom if ever good specimens. Usually the sooner eggs are placed under the incubation process after being laid the greater is the prospect that they will hatch out on time, and the stronger will be the chicks produced. Usually a good hatch is secured only when the eggs commence to pip on the twentieth day and hatch out twenty-four hours later.

■ The fact, however, of eggs not commencing to pip on the twentieth day does not necessarily indicate that they were stale when placed in the incubator. It is more often a proof that the required temperature has not been maintained. For hen or duck eggs the temperature at the level of the top of the eggs on the tray should be about 102° F. the first week, 130° the second and third weeks, and 104° when

hatching. When the correct degree of heat is spoken of it means the temperature required by the germ of the egg, and this is always located at the top of the egg, irrespective of the position in which it is resting, the germ always floating uppermost. The most common cause of eggs failing to hatch at the right time is placing the thermometer too high above them. Say the bulb of the thermometer is from 1 in. to 1½ in. above the eggs, it would require to register 104° to 105° to make sure of them having the desired temperature. Of course, an incorrect temperature may be secured by the reverse position—the thermometer being too far below the level of the top of the eggs.

If the thermometer is kept on a level with the germs, and the hatch delays, it is advisable to have the instrument tested or to secure a new one; it is quite common for thermometers not to register the correct degree of heat in an incubator. A simple method of testing is as follows: Place a clinical thermometer and the one to be tested in water at 100°; stir gently, adding hot water slowly at the same time, and observe the respective readings. If the incubator thermometer reads, say, a degree lower or higher than the clinical, it must be worked a degree higher or lower accordingly.

BROODY HENS.

Especially when the heavier breeds are kept, it will pay to visit the houses nightly and remove to the broody-coop any birds found on the nests. If a bird is removed from the nest on its first desire to sit it will usually lose this desire in two or three days, and will resume laying in a minimum of time, but if left on the nest for days it may be weeks before a normal egg-laying condition is regained. A broody-coop should be made in three compartments, one section being allowed for each day's broodies. Make the bottom of narrow battens fixed, say, 2 in. apart, and raise the coop on legs about 8 in. from the ground; also, unless placed under cover, make it watertight.

The coop should be so arranged that the birds can secure their food and water placed outside. A common but mistaken practice is to starve the broody hen. If egg-production is to be resumed in the shortest time possible, ample food, including meat, should be provided. Cruel methods are sometimes resorted to in trying to stop hens from brooding, such as shutting them under a box for days without food and drink, or by holding their heads under water till they are almost drowned. Obviously, people who resort to such practices have not the love they should have for their fowls, and would be better employed at some other business than poultry-keeping.

ALLEGED INFERTILE EGGS.

Many poultry-keepers, particularly those who are working an incubator for the first time, fail to realize that eggs purchased for hatching purposes and which go rotten during the incubation process must have been fertilized, or they would not have gone bad. If an egg is unfertilized it will remain perfectly clear throughout the whole hatching-period. This is because there is no germ from which life can start. In despatching sittings of eggs the best a breeder can do is to send out only those which he has every reason to believe are fertile. Complaints relative to eggs failing to hatch are sometimes justified, but

in many cases the blame is placed on the wrong shoulders. Very often the person who makes the charge is more to blame for the failure than anybody else, through improper management of the incubator or the sitting hen, as the case may be. Again, eggs may be fertile but through rough handling in transit their hatching-qualities may be spoilt. Such eggs will often germinate, but will fail to live during the incubation period. They will certainly go rotten, as the process of the germ starting to germinate creates a gas which brings this condition about.

Even on the best-managed plants a proportion of infertile eggs may sometimes be sent out; but usually, and rightly so, if these are returned to a breeder he will gladly replace them. He cannot, however, be expected to replace alleged infertile eggs which prove, as a result of his own examination, to be actually fertilized. A case in point came under my notice the other day where a line of eggs which failed to hatch in an incubator was returned to a breeder and alleged to be infertile. On examination the greater part of the line was found to contain fully developed chicks, thus indicating that the failure was due to improper management of the incubator.

Where purchased eggs fail to hatch, much misunderstanding and annoyance would be avoided if trouble were taken to test them before being returned to a breeder, for the purpose of ascertaining whether or not they had been fertilized. Naturally, any breeder will resent being blamed for sending out infertile eggs which contain chicks in an advanced stage of incubation.

—*F. C. Brown, Chief Poultry Instructor, Wellington.*

THE APIARY.

ARTIFICIAL INCREASE.

ARTIFICIAL increase may be accomplished in several ways, but perhaps the most satisfactory is by means of nuclei and division. A nucleus is best formed of two frames of emerging brood and young bees, one frame of honey, and one containing pollen. This must be completed by a virgin queen or a ripe cell. The nuclei may be utilized throughout the season for the mating of queens for renewal, and at the end of the summer—if two or more are united, or if each one is reinforced by the addition of bees and brood from strong colonies—they may be wintered in safety and will form good stocks for the next season. No surplus can be expected from them the year of their installation.

In dividing it is best to wait till the colony is preparing to swarm and ripe queen-cells appear in the hive. The hive can then simply be split in two by putting half the bees and brood on another stand, taking care to leave queen-cells in each division, and for preference putting as much emerging brood in the half which is to be placed in a new position. This latter precaution is necessary in order to make up the wastage from the field-bees that will return to the old stand. Each hive can then be completed by filling the vacancies by drawn-out

combs. The queen-cells in the queenless half will be nursed by the young bees, while those in the half containing the queen will be torn down by the bees when they find the hive depleted. If the apiarist wants to be quite sure of this being done he may search for the queen and remove her while the division is being made, afterwards putting her in the hive on the new stand. The division method is advocated on account of its simplicity and the fact that there is no necessity for finding the queen before the operation. It is a most effectual preventive of swarming, and saves a great deal of trouble where increase is desired.

SUPERING.

In most districts November is early enough for the employment of supers, though much depends on weather conditions. If the weather is warm, the hives full of bees, and nectar coming in freely, the supers may now be added at any time. However, it is of no use discouraging the bees by giving additional space before the weather is warm enough to justify it. If increase is required it is as well to confine the bees to one story till the hive is overflowing with bees. This is almost certain to produce a desire to swarm, and the hive can either be allowed to swarm naturally or be divided artificially. When the first super is put on it is best, if possible, to fill it entirely or partially with drawn-out combs. If only foundation is available, one or two combs—not containing brood—may be removed from the bottom story to the top, and sheets of foundation put in their place. On no account disturb the brood until settled weather eventuates. If foundation is used in the super, queen-excluders should not be used, as the bees will rarely travel through the excluders to work the foundation, and will usually swarm. Do not bring excluders into use until the bees are quite accustomed to working in the supers.

CARE OF BEE-YARD.

Before the supers are put on it is advisable to see that the hives are raised well above the ground, so as to provide ventilation underneath and also to prevent the hives becoming a shelter for insects. The bottom-boards should be raised at least the height of a brick from the ground, and they may even be a little higher, though in the latter case the alighting-board should be long and sloping to enable the heavy-laden workers to reach the hive easily if, as so often happens, they miss the entrance when descending at the end of their homeward flight. All grass and weeds should be cleared away from the hives, particularly at the entrances. To save the continual labour of this operation during the spring and summer it is a good plan to skim the weeds from the ground and to spread agricultural salt in the proportion of about 6 lb. per hive to prevent their reappearance for the season. Although this is only a temporary remedy it should save mowing the grass for at least one season. Whatever the labour, the entrances must be kept free; the bees' lives are all too short and arduous, and the energy wasted in forcing their way through the tangle of weeds sometimes seen in apiaries must amount to a good deal in the course of a season.

—*E. A. Earp, Senior Apiary Instructor, Wellington.*

HORTICULTURE.

THE STRAWBERRY CROP AND OTHER SMALL-FRUIT.

THE strawberry crop will be ready for the pickers during the coming month, and arrangements for its distribution should be made now. This popular fruit requires expert handling to ensure it being delivered to the consumer while the berries have all their freshness and aroma. To do this the fruit must be gathered in the cool of the day when the plants are free of moisture. The stage of ripeness must depend on the distance they have to travel, but at the beginning of the season, when the weather is cool, they should be riper than later in the season, when they will ripen quicker in transit. If the pickers are properly instructed and supervised very little rehandling should be necessary. The berries should be picked with a short stem and placed in the punnets, these must be filled, and the top is required to be a fair sample of the fruit beneath. This is a legal requirement, and shipments packed in any other way are liable to bring trouble on the seller. Overripe, misshapen, and undersized berries should be picked and placed in a separate container and sold for culinary purposes. Keep all punnets and crates clean, as this will add very much to the appearance and value of the pack. The berries at all times must be kept in a shaded cool place that is free from dust. Gritty and rain-splashed berries are of no value, so the mulch of straw or rushes should be laid in good time to avoid that danger.

Culinary gooseberries will also soon be ready for gathering. They should be marketed promptly, before the early stone-fruit commences to come on the market. Culinary fruit is in short supply at this season, and gooseberries are useful in supplying it during this interval.

Raspberry and loganberry plantings now require light cultivation in fine weather to destroy weeds and conserve moisture. Apply nitrogenous fertilizers as necessary to induce satisfactory growth, and remove unnecessary sucker growths in the alleys.

TOMATOES.

The outdoor tomato crop will now be getting established. Cultivation should be shallow, so as to avoid disturbing the roots, as, like most fruiting plants, tomatoes do best in a well-compacted soil. Tying and suckering will require prompt attention in order to prevent the plants making unnecessary growth and thus delaying the early crop. Keep a sharp lookout for any sign of disease, and fill all gaps as soon as they occur with specially prepared plants.

The tomato crop under glass will now commence to ripen, and where the subsoil is inclined to be dry a mulch of stable litter should be laid. Trim off the leaves that shade the bottom bunch, and feed the plants judiciously at short intervals. Keep the plants rather on the warm side, as a chill now will cause delayed ripening. Should any sign of black-stripe disease appear, the plants should be given a dressing of potash fertilizer without delay.

TOBACCO-GROWING.

The earlier plantings of tobacco will now be established in the field. There should be very few gaps in the rows if the plants were well

selected and carefully placed. Any replacements should be made promptly with specially selected plants, as otherwise such replacements are backward and cause more work than they are worth. Hoeing and cultivation may now be done with horse-drawn implements, and, if regularly attended to, the plants will benefit, and very little hand cultivation and hoeing will be required later when the danger of damaging the leaf makes cultivation with horses impracticable. The sooner planting is completed the better, for reasons previously stated in these notes.

VEGETABLES.

With the completion of the planting of the half-hardy crops previously mentioned, the work now chiefly consists in thinning, hoeing, and feeding the growing crops. Where seeds of known germination have been sown thinly, the tiresome task of thinning will take little time; but whatever work of this kind is required it should be done early, or growth is delayed and the plants suffer seriously. If fine bright weather is chosen for hoeing and cultivation, the best and quickest results are obtained. Judicious feeding with fertilizers from time to time requires experience and close attention, but much can be accomplished by such means.

Where winter crops are to follow the early the latter should be lifted promptly, so that the heavy dressings of manure the winter crops require may be given and the land allowed to settle into a firm bed ready for planting about the end of the year. These winter crops—now in the seed-beds—are very subject to insect enemies, but the application of a spray compound of arsenate of lead and tobacco concentrate administered at intervals of a fortnight, when necessary, is the most effective remedy we have.

NATIVE TREES AND SHRUBS.

The art of effective planting of trees and shrubs is acquired only by observation at all seasons of the year. From notes thus made the planter is prepared in the autumn to make out a satisfactory order for his requirements of trees and shrubs. The brilliant display this spring of both yellow and red kowhai, the shining mantles of clematis hanging in the higher trees, and plumes of well-grown rangiora, when seen together quite refute the charge of the dullness of our native groves one so often hears. The red kowhai (kowhai-ngutu-kaka of the Maori) is rare in the bush, and is found in very few places outside some of the islands of the Auckland District. It is known botanically as *Clianthus puniceus*, and among the many seedlings grown there are a few with blossoms of very large size and rare shades of colour. These plants—and most others—are most effective when planted in rather large groups in a suitable environment. They should certainly receive more attention from those who make a feature of native plants in their gardens.

—W. C. Hyde, Horticulturist, Wellington.

Exportation of Stud Stock.—During the official year 1926–27 the stud stock exported from New Zealand consisted of 5,327 sheep, 57 cattle, 16 horses, and 5 pigs.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

SCABS ON COWS' TEATS.

"DAIRYMAN," Kiwitahi Railway :—

I should be much obliged if you could advise me how to treat and cure "black-scab" (as we call it) on cows' teats. Also, is it contagious? I have seen it on cows once or twice in previous seasons, but was unable to cure it, though trying all kinds of ointments and disinfectants. This year I have two cows affected. The trouble begins with just a small round scab on the teat, which rapidly gets larger, and the whole teat becomes hard and inflamed, making it almost impossible to get the milk from the quarters. In one case the inflammation has gone down but the scab is obstinate.

The Live-stock Division :—

The probable commencement of these scabs on cows' teats is the ordinary cow-pox lesion, which, owing to the friction inevitable during the milking process, has burst and become infected with other germs, thus making a sore which is very obstinate to heal. The teats should be washed in warm soda water to soften the scabs, and then the sores should be regularly dressed with a preparation made by mixing equal parts of zinc ointment and boracic ointment. When milking affected teats this ointment should be freely used in order to keep the part soft, the milk being given to calves or pigs. This disease may be carried from cow to cow by milkers' hands or by teat-cups. Therefore affected cows should be milked last, and all possible sources of infection eliminated by washing the hands or by dipping the cups in boiling water after milking each affected cow.

WHITEWASHES FOR MILKING-SHEDS.

"SUBSCRIBER," Nireaha :—

I should be obliged if you would give me a recipe for making a whitewash suitable for milking-sheds.

The Dairy Division :—

Three recipes are appended. No. 2 is an outdoor whitewash, and it will made with withstand rain for years. No. 3 is the best for woodwork.

(1) One sack of rock lime, 8 lb mutton-fat, 10 gallons butcher's brine. In watertight tub put the lime and fat in alternate layers, add hot water to cover this, and let stand twenty-four hours with sack over tub. Add 10 gallons of butcher's brine, and stir. Put through a fine sieve, and add water if too thick for use. If cream colour is required, add to the mixture 5 lb. green copperas dissolved in hot water.

(2) In a tub put 2 gallons of pulverized unslaked lime and plenty of water to slake it. Stir in about $\frac{1}{2}$ lb. of tallow or other grease, and mix well. Then add hot water enough for use.

(3) In a tub put 45 lb. pulverized unslaked lime, and slake by pouring over it boiling water sufficient to cover 4 in. or 5 in. deep, stirring until quite slaked. Dissolve in water, and add 2 lb. sulphate of zinc and 1 lb. common salt, which will cause the wash to harden on woodwork. Add sufficient water to make workable. To make cream colour, add 3 lb. yellow ochre; fawn colour, 4 lb. umber, 1 lb. Indian red, and 1 lb. lampblack; grey or stone colour, 4 lb. umber, 2 lb. lampblack.

FEEDING-VALUE OF THRESHED CRESTED-DOGSTAIL HAY.

O. W. GREEN, South Makirikiri :—

Kindly inform me as to the feeding-value, as feed for milking-cows, of crested-dogstail hay having been through the threshing-mill.

The Fields Division :—

The feeding-value will greatly depend on the condition of the crested-dogstail straw. If it was saved in good order and is still bright it should be a very useful fodder to feed in conjunction with roots or other green material, and for this purpose should be worth about half as much as good meadow hay. If, on the other hand, no roots or green material are available it would not be so valuable. The grass would naturally be dry for threshing, and this would prevent the cows digesting large quantities; and if they were overfed on it they could not be expected to milk well.

SORGHUM AND COWS.

“ INQUIRER,” Leigh :—

Please inform me whether sorghum at any stage of its growth will cause abortion in cows when eaten.

The Live-stock Division :—

It may be taken that abortion among cows is almost always caused by the specific organism or bacillus, and that, broadly speaking, feed has little to do with the slipping of calves. While this fact is recognized, cows may abort owing to a severe general disturbance of the system such as obtains in some acute infectious diseases, or perhaps in acute indigestion accompanied by excessive tympany or bloat. Sorghum belongs to the cyanogenetic group of plants, and there is some danger that the immature material or second growth after cutting may cause prussic-acid poisoning. If a cow became poisoned by feeding on immature sorghum, it is possible that her system might be so upset that the calf would be expelled prematurely; but as long as she remained apparently normal she would not abort as a direct result of eating sorghum. Sorghum should be allowed to ripen, or cut and allowed to wither, before being fed to cows.

FEEDING OF CALVES AND PIGS.

“ INQUIRER,” Whakaangi :—

Should oats be used crushed or whole for calves, and how much should a calf receive? Should barley be soaked in hot water before giving to pigs, and how much should a weaner receive? Will maize do for young pigs instead of barley? I can buy it for 6s or 7s. a sack in the cob, which is equal to about 16s. or 18s. a sack shelled, and barley costs about 6s a sack in freight, besides the first cost of the grain.

The Live-stock Division :—

It is advisable to feed calves on crushed oats rather than whole oats. Start with a handful, increasing up to $\frac{1}{2}$ lb daily when five months old. As regards the question of feeding soaked barley to pigs, it would depend largely on the number of pigs being fed and the facilities for procuring the hot water. Experiment does not show any increased benefit from soaking or boiling barley before feeding. The greatest benefit is derived from barley when fed as meal. As to the quantity to feed, a weaner can with safety consume up to 1 lb. per day for each month of age. The quantity will depend on what other food is being used. If this is separated milk, allow, say, 7 lb milk to represent 1 lb. barley. That means that an eight-weeks weaner will receive 7 lb. separated milk and 1 lb. barley, or 1 gallon milk and $\frac{1}{2}$ lb. barley, if intended for pork. If for bacon, feed at the rate of 1 lb. of grain or substitute for every month of age, less one month after the fourth month. In other words, a five-months pig will receive 4 lb. of grain or substitute per day. For young pigs maize may be substituted for barley, but is not so good. In your case, however, cost appears to justify its use. Maize does not give as fine a finished product in quality and colour as barley.

Noxious-weed Order.—The Masterton County Council has declared hemlock (*Conium maculatum*) to be a noxious weed within that county.

ANNUAL SHEEP RETURNS AS AT 30TH APRIL, 1927.

TABLE I.—SUMMARY BY SHEEP DISTRICTS.

Class.	Auckland.	Napier-Gisborne.	Wellington-West Coast	Marlborough-Nelson-Westland.	Canterbury-Kaikoura	Otago (including Southland).	Total in Dominion.
Stud rams (entered in flock-books)	1,093	1,052	3,806	865	2,877	2,641	12,334
Other rams	32,983	94,473	77,422	20,221	78,422	72,419	375,940
Wethers	363,750	636,681	658,474	236,774	510,719	668,576	3,074,974
Breeding ewes	1,251,412	3,612,142	3,041,878	730,036	3,237,513	2,958,749	14,831,730
Dry ewes	70,440	175,416	175,416	47,824	141,006	128,946	831,691
Lambs	569,810	1,705,477	1,393,452	333,928	1,131,874	1,387,806	6,522,347
Totals, 1927	2,289,488	6,317,884	5,350,448	1,369,648	5,102,411	5,219,137	25,649,016
Totals, 1926	2,244,603	6,236,211	5,349,436	1,352,075	4,971,322	4,750,346	24,904,993

TABLE II.—COMPARATIVE STATEMENT: TEN YEARS, 1918-27.

Year.	Sheep of Distinctive Breed not entered in Flock-books, and Crossbred Sheep.				Grand Total, Stud and other Sheep.		
	Stud and Flock Rams	Stud Breeding ewes	Stud Dry Ewes	Stud Lambs	Total Stud Sheep and Flock Rams	Wethers	Lambs.
1918	325,111	171,437	6,297	125,116	627,961	3,696,520	7,770,772
1919	321,304	165,676	12,196	127,150	626,326	3,922,632	7,304,171
1920	306,621	154,516	9,803	109,454	580,394	3,901,742	6,208,284
1921	322,144	158,608	9,513	110,428	600,693	3,634,799	5,724,053
1922	322,072	154,277	7,259	98,221	581,829	2,727,624	5,618,240
1923	330,955	172,843	9,013	119,749	631,660	2,551,627	6,109,073
1924	332,814	179,533	9,727	132,137	654,211	2,807,832	6,381,249
1925	355,579	184,744	7,867	131,485	679,675	3,063,663	6,398,239
1926	370,535	192,055	10,053	138,526	711,169	3,212,435	6,155,510
1927	388,274	199,219	8,644	141,897	741,034	3,074,974	6,377,450

TABLE III.—DISTRIBUTION OF THE VARIOUS BREEDS, AND OF CROSSBREDS, IN EACH SHEEP DISTRICT (1927).

Breed	Auckland.	Napier-Gisborne.	Wellington-West Coast.	Total in North Island.	Marlborough-Nelson-Westland.	Canterbury-Kaikoura.	Otago.	Total in South Island.	Total in Dominion.
Stud sheep (entered in flock-books)—									
Merino ..	..	..	15	15	9,682	14,284	5,990	29,956	29,971
Lincoln ..	..	..	6,674	6,674	506	129	679	1,314	10,520
Romney ..	432	2,100	78,715	112,002	10,630	4,819	36,895	52,344	164,346
Border Leicester ..	18,015	15,272	710	1,140	410	11,007	11,854	23,271	24,411
English Leicester ..	430	..	160	1,591	1,205	17,294	312	18,811	20,402
Shropshire ..	855	576	586	649	60	2,885	940	3,885	4,834
Southdown ..	303	..	26,324	36,630	903	14,950	1,507	17,420	54,050
Corriedale ..	2,839	7,467	1,157	1,884	909	36,707	10,341	47,957	49,841
Ryeland ..	456	271	547	1,673	84	1,470	127	1,681	3,354
Other breeds ..	587	530	99	1,38	1,347	1,739	141	3,227	3,365
Totals ..	30	20,225	114,087	105,228	25,796	105,284	68,786	199,866	365,094
Sheep of a distinctive breed but not entered in flock-books—									
Merino ..	..	..	22,969	55,576	215	819	301,385	950,228	1,005,807
Lincoln ..	7,990	24,620	23,377	56,621	3,483	5,881	18,497	27,861	84,482
Romney ..	10,035	23,209	1,047,305	2,881,358	125,399	79,481	224,731	429,611	3,310,969
Border Leicester ..	333,214	1,500,839	1,306	6,855	3,270	25,220	34,060	62,550	69,405
English Leicester ..	4,043	1,432	1,391	5,979	7,510	37,569	4,352	49,431	55,410
Shropshire ..	3,794	1,684	501	1,395	1,395	5,841	3,187	10,423	17,555
Southdown ..	5,614	273	1,245	7,132	800	14,082	1,315	16,200	26,102
Corriedale ..	6,377	20,851	52,008	79,836	23,216	510,304	317,127	850,647	886,307
Half-breeds ..	3,860	1,081	30,719	35,660	253,817	691,222	267,463	1,212,502	1,229,346
Ryeland ..	3,488	657	12,699	16,844	49	921	99	1,069	1,888
Other breeds ..	244	378	197	819	90	270	573	942	2,442
Totals ..	481	624	395	1,500	634,926	1,803,315	1,173,289	3,611,530	6,759,713
Crossbreeds and others not otherwise enumerated									
..	379,140	1,575,648	1,193,395	3,148,183	708,926	3,193,812	3,977,062	7,879,800	18,524,209
Grand totals ..	1,886,332	4,716,011	4,042,066	10,644,499	1,369,648	5,102,411	5,219,137	11,691,196	25,649,016

WEATHER RECORDS : SEPTEMBER, 1927.

THE Director of the Dominion Meteorological Office (Dr. E. Kidson) reports as follows :—

The total rainfall of the month was above normal over the North Island, except at places in the central region and between Wanganui and Wellington. In the South Island, Otago had more than the average, and Blenheim also reported an excess, but elsewhere there was a deficiency. The greatest differences from the mean are shown on the eastern coasts, Gisborne having 76 per cent. above and Christchurch 73 per cent. below.

There were no general heavy rains during the month, but several occasions on which heavy local falls occurred. For instance, on the 5th and 6th very heavy rain was experienced in Otago, the effect of a low centre passing in that region. Floods resulted in some of the rivers, and much of the low-lying country was under water at this time. On the 27th and 28th a cyclone centred off East Cape brought heavy rain to the Gisborne and Hawke's Bay districts. The most generally unsettled period was between the 17th and 27th. Dull, misty, and showery conditions prevailed, and on the 25th some snow fell in the South Island in the rear of an intense Antarctic disturbance. Anticyclonic conditions with fair weather ruled in the beginning, from the 13th to the 17th, and at the close of the month.

Although dull weather was frequent there were no severe cold periods, and, from observers' remarks, conditions appear to have been favourable for lambing, and the month generally was a good growing one.

RAINFALL FOR SEPTEMBER, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.
<i>North Island</i>				
	Inches.		Inches.	Inches.
Kaitaia	5·72	17	1·06	4·75
Russell	4·47	13	1·11	4·66
Whangarei	5·97	18	1·62	5·03
Auckland	4·31	21	1·04	3·65
Hamilton	3·83	17	0·88	4·40
Kawhia	6·68	23	1·16	4·39
New Plymouth	5·43	15	1·26	5·27
Riversdale, Inglewood	8·76	15	2·25	9·48
Eltham	4·05	15	0·72	3·91
Whangamomona	4·63	11	0·96	7·57
Tairua	5·28	15	2·28	4·64
Tauranga	4·80	15	1·00	4·41
Maraehako Station, Opotiki	4·80	14	1·38	4·18
Gisborne	5·31	12	2·26	3·01
Taupo	3·05	9	0·83	3·71
Napier	3·46	13	1·80	2·19
Maraekakaho Station, Hastings	2·96	18	1·37	2·58
Taihape	1·45	17	0·26	3·44
Masterton	1·06	11	0·22	3·13
Patea	2·69	13	0·60	3·63
Wanganui	1·37	8	0·39	2·96
Foxton	2·20	10	0·50	2·43
Wellington	3·07	16	1·23	3·99
<i>South Island.</i>				
Westport	6·50	17	1·58	6·82
Greymouth	5·25	17	1·54	7·96
Hokitika	7·54	16	1·59	9·33
Ross	8·91	12	1·71	13·06
Arthur's Pass	7·35	11	1·56	15·50
Collingwood	8·54	12	1·51	10·13

RAINFALL FOR SEPTEMBER, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average September Rainfall.
<i>South Island—continued.</i>				
	Inches.		Inches.	Inches
Nelson	3·75	9	1·10	3·75
Spring Creek, Blenheim	3·31	11	0·88	2·69
Tophouse	5·33	12	1·20	5·47
Hanmer Springs	1·56	11	0·62	4·20
Highfield, Waiau	1·42	7	0·58	3·12
Gore Bay	1·27	9	0·34	3·31
Christchurch	0·48	8	0·20	1·79
Timaru	1·56	10	0·50	2·07
Lambrook Station, Fairlie	1·70	6	0·86	2·21
Benmore Station, Clearburn	1·60	8	0·68	2·14
Oamaru	1·93	8	0·78	1·69
Queenstown	1·58	8	0·75	2·47
Clyde	1·73	6	0·49	1·06
Dunedin	4·90	11	2·25	2·74
Wendon	5·54	8	2·35	2·12
Gore	4·42	13	1·33	2·52
Invercargill	3·89	20	1·48	3·11
Puysegur Point	8·36	19	2·34	5·53

MAMMITIS IN DAIRY HERDS.

THIS subject is dealt with by the Director-General of Agriculture in his annual report for 1926-27, as follows —

Mammitis is reported as having been less prevalent during the year, but plenty of cases still occur and much loss is caused. In order to combat mammitis there is no doubt that careful management of the herd and constant care in watching for and detecting cases in their early stage are necessary. The udder of the cow is a most delicately constructed organ, highly susceptible to any influences which will cause irritation or disturbance of its normal functions, and this is especially the case when the animal is in full milk. The very general use of milking-machines accentuates the necessity for the exercise of the greatest care. Owing to the conditions existing here milking-machines have become a practical necessity, and they are undoubtedly a valuable adjunct to the dairy farm, but if carelessly handled, or if kept in an uncleanly condition, they may do much harm, and the necessity for the exercise of every care in regard to them cannot be too strongly emphasized. With hand milking the presence of any inflammatory condition of the udder can be quickly noted while the trouble is in its early stages, but with the machine it may easily be overlooked until it has become severe, by which time contagion, if it be present, may have spread to other cows in the herd. Again, driving a machine at too high pressure is calculated to produce udder trouble, as also is omission to remove the machine-cups immediately the udder has been milked out. Dirt is also bad, whether in the machine parts or in the shed or its immediate surroundings. Apart from trouble arising from this cause, however, contagious mammitis not infrequently occurs among hand-milked cows, and it needs to be consistently guarded against. The departmental field officers are always willing to advise dairy-farmers both as to preventive and remedial treatment, and their services are largely called upon.

At the Wallaceville Laboratory steady research work is going on, and some interesting experiments have been carried out, these including the use in herds of a vaccine (known as an autogenous vaccine) prepared from the milk of a cow in the herd suffering from contagious mammitis. A range of results sufficiently wide to enable any reasonably definite conclusion to be arrived at has not yet been reached, but the work is going on, and it may open up a line of effort towards a method involving less time and trouble in application.

Reports have been received from Stock Inspectors throughout the Dominion regarding the results of the use of proprietary preventive vaccines for mammitis. These embody varying opinions from farmers on whose herds the vaccines have been tried, but the balance of opinion is against their efficacy.

AGRICULTURAL SHOWS, SEASON 1927-28.

THE following show-dates have been notified by agricultural and pastoral associations :--

Hawke's Bay A. and P. Society : Tomoana, 19th and 20th October, 1927.
 Poverty Bay A. and P. Association : Gisborne, 25th and 26th October
 Wairarapa A. and P. Society : Carterton, 26th and 27th October
 Marlborough A. and P. Association : Blenheim, 26th and 27th October.
 Timaru A. and P. Association : Timaru, 26th and 27th October.
 Manawatu A. and P. Association : Palmerston North, 1st, 2nd, and 3rd November.
 Kelso A. and P. Association : Kelso, 2nd November.
 Northern A. and P. Association : Rangiora, 4th November.
 Wanganui A. and P. Association : Wanganui, 9th and 10th November.
 Canterbury A. and P. Association : **Royal Show**, Christchurch 9th, 10th, and 11th November
 Waimate A. and P. Association : Waimate, 15th November
 Egmont A. and P. Association : Hawera, 16th and 17th November.
 North Otago A. and P. Association : Oamaru, 17th and 18th November
 Otago A. and P. Society : Dunedin, 23rd and 24th November
 Stratford A. and P. Association : Stratford, 23rd and 24th November
 Tokomairiro Farmers' Club : Milton, 28th November
 Clutha and Matau A. and P. Society : Balclutha, 1st and 2nd December.
 Auckland Metropolitan A. and P. Association : Auckland, 2nd and 3rd December.
 Wyndham A. and P. Association : Wyndham, 9th December
 Otago Peninsula A. and P. Society : 10th December
 Nuhaka A. and P. Association : Nuhaka, 1st January, 1928
 Marton District A. and P. Association : Marton, 18th January
 Waipukurau A. and P. Association : Waipukurau, 20th January
 Horowhenua A. and P. Association : Levin, 24th and 25th January
 Tapanui Farmers' Club : Tapanui, 25th January
 Rangitikei A. and P. Association : Taihape, 25th and 26th January
 Helensville A. and P. Association : Helensville, 30th January.
 Golden Bay A. and P. Association : Motupipi, 1st February.
 Woodville A. and P. Association : Woodville, 3rd and 4th February
 Omaha and Pakiri A. and H. Association : Leigh, 4th February.
 Clevedon A. and P. Association : Clevedon, 4th February
 Feilding A. and P. Association : Feilding, 7th and 8th February.
 Dannevirke A. and P. Association : Dannevirke, 8th, 9th, and 10th February.
 Hikurangi-Otonga A. and P. Association : Hikurangi, 9th February.
 Masterton A. and P. Association : Solway, 14th and 15th February.
 Te Awamutu A. and P. Association : Te Awamutu, 15th February.
 Taumarunui A. and P. Association : Taumarunui, 15th February.
 Ohura A. and P. Association : Matiere, 22nd and 23rd February.
 Franklin A. and P. Association : Pukekohe, 24th and 25th February.
 Tauranga A. and P. Association : Tauranga, 29th February
 Hukerenui Agricultural Association : Hukerenui, 1st March.
 Mongonui County A. and P. Association : Kaitaia, 3rd March.
 Opotiki A. and P. Association : Opotiki, 6th March.
 Taranaki Agricultural Society : New Plymouth, 7th and 8th March.
 Matamata A. and P. Association : Matamata, 13th March.
 Kaikoura A. and P. Association : Kaikoura, 16th March.
 Mayfield A. and P. Association : Mayfield, 17th March.
 Hawarden A. and P. Association : Hawarden, 23rd March.
 Methven A. and P. Association : Methven, 29th March.
 Oxford A. and P. Association : Oxford, 5th April.

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No. 5.

THE GUM-TREE WEEVIL AND ITS PARASITES.

PRELIMINARY CONTROL WORK IN NEW ZEALAND.

DAVID MILLER, Entomologist, Biological Laboratory, Wellington.

OF recent years the Australian gum-tree weevil (*Gonipterus scutellatus*) has become of major importance as a pest of Eucalyptus in many parts of New Zealand and South Africa. The position became so acute that some time ago the writer and Mr. C. P. Lounsbury, then Chief of Division of Entomology, Pretoria, entered into co-operation with a view to securing for shipment to Africa and New Zealand parasites of the weevil from Australia. As nothing was then known of the weevil and its parasites in Australia, an attempt was first made to secure the services of a Commonwealth entomologist to undertake the search for the required parasites. However, no one being available in Australia, Mr. Lounsbury decided to take up the work, and Mr. F. C. Tooke, of his Division, has been stationed in South Australia for some time past.

Mr. Tooke's mission has proved remarkably successful in that he not only located parasites of the pest but also successfully made shipments to South Africa. Through the kindness of Mr. Lounsbury he also sent a consignment of parasites to the writer for establishment in New Zealand. It is understood that a full account of the work in Australia and South Africa, and also of the parasites, will be published by the Union entomologists; the present article is merely a record of the position as regards New Zealand.

LIFE-HISTORY OF THE WEEVIL.

During winter the adult beetles (Fig. 1) collect in large numbers under the loose bark on the bole of eucalypts, especially those of blue-gums (*E. globulus*), where the best shelter is to be found. The hibernating period of the beetle is from May to August (inclusive), and in some localities is prolonged into September. After hibernation the beetles migrate to the young foliage and there lay their eggs. It is especially noticeable that these spring eggs are most abundant on blue-gum, due no doubt to the fact that this species, by affording the

best winter quarters, is most heavily populated by the weevils in spring. Later the beetles migrate to other species of eucalypts, where the eggs of the second generation abound, being especially abundant on *E. viminalis*.

. Egg-laying continues for several weeks in the spring, and does not cease until November. The eggs are laid in small blackish cases



FIG. 1. WEEVIL ATTACKING LEAF. 6.

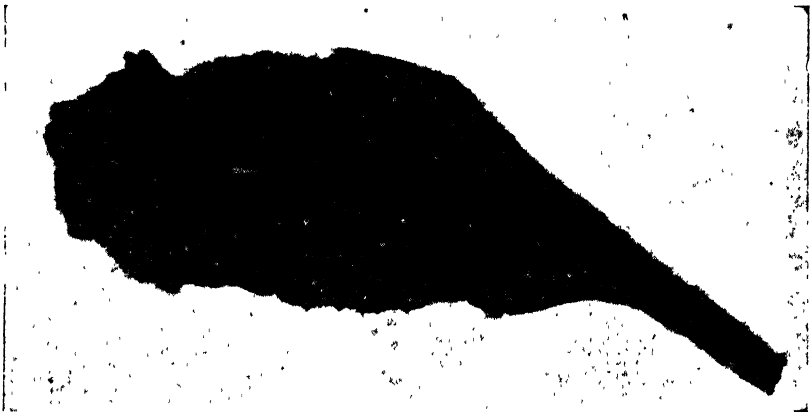


FIG. 2. EGG-CASE OF WEEVIL ON LEAF. $\times 5$.

(Fig. 2), each of which contains a varying number (as many as a dozen) and is attached to the young leaves. The newly hatched larvæ emerge from the egg-cases by eating their way through the leaf, so that the cases appear intact even after all the larvæ have left them.

The legless larvæ, which attack the surface of the foliage, eating narrow slits therefrom (Fig. 3), are at first yellowish, darkly striped along the sides, and studded with small black dots (Fig. 4): the mature larvæ become yellowish-green, and slug-like in general appearance (Fig. 5). The larval period on an average extends over four or five weeks, when the larvæ leave the trees, enter the ground, and pupate. The duration of the pupal period is three or four weeks,

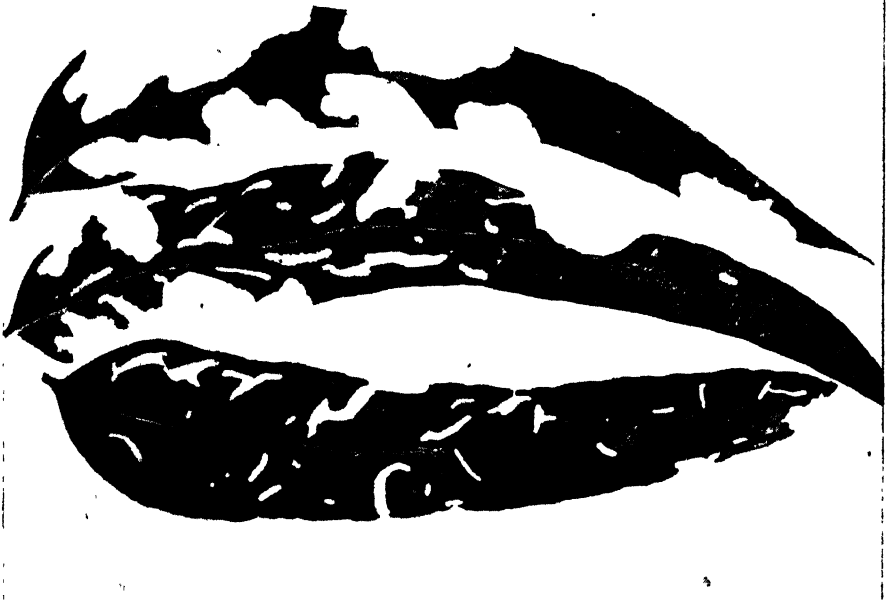


FIG. 3. LEAVES DAMAGED BY WEEVIL AND ITS LARVÆ

and the complete cycle, from the laying of the eggs to emergence of the weevils, extends from eight to twelve weeks.

In December and January the second or summer brood of weevils is in abundance, and the insects are then found on most species of Eucalyptus, but more specially on *globulus* and *viminalis*. Egg-laying again takes place, and by March and April the larvæ (second or summer generation) have again left the trees to pupate in the ground. During this period, also, the hibernating weevils commence to become abundant and migrate to their winter quarters on the blue-gum.

In the main there are two generations each year, the autumn (hibernating) and the summer generations.

NATURE OF DAMAGE BY WEEVIL.

The gum-tree weevil causes damage to eucalypts both as larva and adult, the former eating from the surface of the foliage, and the latter not only devouring the margin of foliage but also eating down



FIG. 4. YOUNG WEEVIL LARVA ON LEAF. 5



FIG. 5. ADULT WEEVIL LARVA. 6.

tender shoots and epidermis from older ones. The infestation is frequently so severe that the trees become stunted. *E. globulus* and *E. viminalis* are the most severely attacked species. The autumn

brood of weevils also does some damage to growing apples, principally attacking the stalk, but often the epidermis.

THE PARASITES.

Among the parasites discovered in Australia by Mr. Tooke is a species of mymarid (Fig. 6) that parasitizes the eggs of the weevil. On 20th October (last month) a consignment of parasitized weevil-eggs sent by Mr. Tooke was received by the writer. These eggs were shipped in glass tubes, the leaf to which each egg-case was attached having been trimmed down and a pin driven through it; a number of egg-cases were thus pinned on a slip of cardboard in each tube. A total of 220 egg-capsules was in this consignment.

On arrival a considerable number (approximately 200) of mymarids had emerged and were dead, but numbers were still emerging. The latter were removed and placed in smaller tubes containing local eggs, three parasites on an average being enclosed with from twelve to eighteen egg-cases. Though on examination all these parasites seemed to be the one species, it was considered advisable to ascertain this definitely. In a number of tubes, each containing six egg-cases, a single parasite was placed, and if it is found that the mymarid emerges from these, that material will be used in the first field liberations.

In almost all cases, as soon as placed with the local egg-capsules, the parasites commenced to oviposit in the weevil-eggs (Fig. 7), and there is every prospect of the successful establishment of this parasite. Though no hyperparasites have been noted in Australia, or from the material sent to Africa, a chalcid had developed from the material sent to New Zealand, and this insect has been segregated in order to ascertain its relationship, if any, with the mymarid.

The following is the record of parasite emergences from the Australian consignment up to date of writing (2nd November): -

Emergence Date.	Parasite.		Emergence Date	Parasite	
	Mymarid.	Chalcid.		Mymarid.	Chalcid.
Oct. 20	..	22	..	25	1
" 21	..	51	..	8	3
" 22	..	41	..	..	2
" 23	..	5	..	4	3
" 24	..	4	Nov. 1	..	3
" 25	..	6	" 2	..	6
" 27	..	24	..	..	..
			Totals	190	18

As far as the observations have gone the percentage of mymarid parasitism in the Australian material is not very high, considering that a total of 390 mymarids (including the 200 found dead on arrival) has emerged from 220 egg-cases, each of which contains several eggs. Under New Zealand conditions, however, and free of natural controlling influences there is every possibility of this mymarid successfully controlling the weevil in the Dominion. A feature in the foregoing

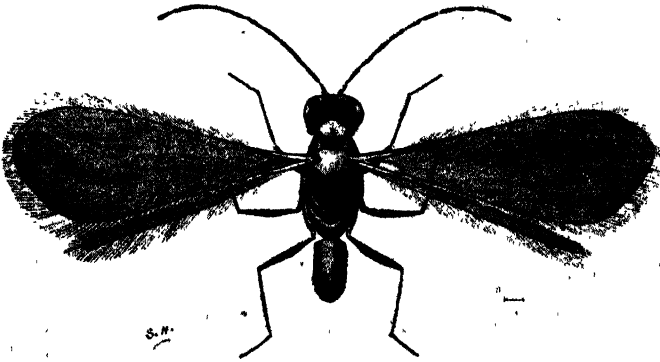
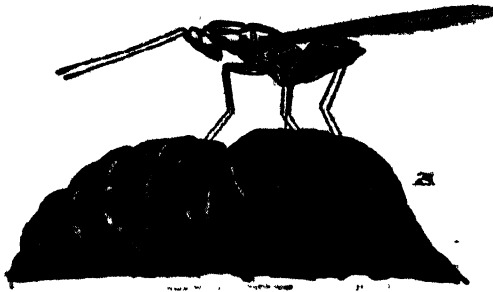


FIG. 6 MYMARID PARASITIC ON EGGS OF WEEVIL
Natural size shown by the small line on right below wings



(a)



(b)

FIG. 7. MYMARID OVIPOSITING IN WEEVIL EGG-CASE.

(a) Placing ovipositor in position; (b) ovipositor driven home. Natural size shown by small facsimile on right of each drawing.

table, showing a possible relationship between mymarid and chalcid, is that as the former decreases the latter increases.

We are greatly indebted to Mr. C. P. Lounsbury and Mr. F. C. Tooke for their generous aid towards the parasitic control of the gum-tree weevil in New Zealand. The accompanying drawings of the mymarid parasite (Figs. 6 and 7) are the work of Miss S. Hudson, of the Biological Laboratory staff.

TESTING OF NEW-ZEALAND-GROWN WHEATS.

RESULTS FOR YEARS 1926 AND 1927.

F. J. A. BROGAN, M.Sc., Analyst, Chemistry Section, Wellington.

II.—QUALITY OF FLOURS.

THE milling-qualities of a number of wheats from the 1926 and 1927 harvests were summarized in the *Journal* for September last. The quality of the flours obtained, as indicated by chemical analysis, is discussed in the present article.

It should be borne in mind that no system of chemical analysis yet devised can give conclusive evidence as to the behaviour of a flour on being made into bread ; but, apart from this consideration, the information obtained is of assistance to the baker in indicating the best method of handling the flour in the bakery. The various chemical tests usually performed, and their relative significance, have been described in previous *Journal* articles, but for the convenience of the reader a brief *résumé* is here given.

PROTEIN.

Opinion is divided on the question of which chemical constituent of flour is most closely connected with strength. The crude protein content is perhaps most in favour, followed by the quantity and quality of the gluten. As the greater part of the protein substance of wheat is contained in the gluten, the quantity of gluten in a flour must be a guide to its strength or power to produce a loaf of good volume and texture. If a flour containing a good amount of gluten fails to make a good loaf the physical structure or quality of the gluten must be at fault. The method of arriving at an estimate of the quality of gluten is given below.

GLUTEN.

The method of estimating gluten consists in making the flour into a dough, and then washing away the starch and soluble matter under a stream of water. The temperature and rate of flow of the water and length of washing must be carefully controlled if concordant results are to be obtained. The personal factor leads to discrepancies in the results from different operators, but each operator gets essentially consistent results. The ratio of wet to dry gluten gives an indication

of the probable behaviour of the dough. A ratio of from 3.0 to 1 to 3.1 to 1 indicates a flour of good strength as a rule. If the ratio is much above this the dough will not stand up well on fermentation; and if much below 2.9 to 1 the gluten becomes tough and requires strong fermentation to give good results. The quality of the gluten is determined by an inspection of its elasticity, colour, and cohesion. Gluten of low quality is greyish in colour, sticky, and of poor elasticity.

MOISTURE AND ASH.

The moisture content of New Zealand flours varies within narrow limits, and calls for no special comment. The amount of water absorbed by a given weight of flour in order to produce a dough of good consistency is, of course, influenced by the moisture content. The percentage of ash is a guide to the grade of the flour, and thus to the completeness of the milling operations, but due consideration must be given to the variety of wheat from which it is obtained. Durum or macaroni wheats have a very high ash content, yet the flour is of good strength, and with proper treatment is capable of producing bread of good quality. The ash of a straight grade flour usually varies from 0.54 to 0.61 per cent. A glance at the accompanying tables will show that the average figure for the flours examined is rather higher than this.

COLOUR OF FLOUR.

The colour of flour depends chiefly on two factors. There is, first, the effect due to carotin, the natural yellow pigment of flour, and, second, the effect due to minute particles of bran, which contain a reddish-brown pigment. The yellow pigment is removed by bleaching, while the other is not. The Pékar test, which is usually employed by millers, was used in the work here recorded. It consists in wetting compressed wedges of the flour to be compared, placed side by side, and drying in the steam-oven. The colour of the flour becomes darker owing to oxidation, and comparison is more readily effected. A light-cream colour is considered most satisfactory. Dead white indicates excess of starch and gluten of poor quality, while the appearance of a brown tint reveals the presence of bran particles. Kent Jones (2) has recently devised a method of obtaining a numerical expression for the colour of flour. The yellow and reddish-brown pigments are separately extracted by different solvents, and the colours compared with solutions of standard tints. The grade of the flour may be judged by the amount of reddish-brown pigment present, which presumably comes from the finely-powdered offal. No correlation was observed by the present writer between the colour of the flour and that of the gluten.

Notes on the Tabulated Results.

1926 Series (Table 3).

A sample of Collège Hunter's wheat (W 257) contained the highest amount of protein in this series, comparing favourably with previously recorded figures; the gluten, present in good quantity, was also of good quality; the ash content was somewhat high, and the colour of the flour rather poor. Another sample (W 152), from Ashburton, contained much less protein, but the quality of the gluten appeared

Table 3.—*Chemical Analyses, 1926 Harvest Wheats.*

Laboratory No.	Variety.	Locality where grown.	Calculated Weight per Bushel	Flour.		Absorption of Water.	Gluten.		Ratio of Wet to Dry Gluten.	Protein (N. x 6.25).	Ash.	Colour of Experimental Flour.	Quality of Gluten by Appearance.
				Per Cent.	Per Cent.		Per Cent.	Per Cent.					
W			lb.	74.4	13.21	50.0	40.11	12.37	3.24	11.25	0.60	Poor	Good.
257	College Hunter's	Horrelville	63	75.3	13.01	53.0	33.40	11.17	3.00	11.06	0.63	Fair	Good.
168	Jumbuck	"	64	75.7	13.84	18.4	40.19	11.95	3.36	10.88	0.54	"	Poor.
171	White-straw Tuscan	"	64	73.6	13.38	53.4	33.04	11.49	2.95	10.75	0.72	Good	Good.
154	Jumbuck	Ashburton	61	71.2	12.57	50.4	33.60	10.78	3.12	9.88	0.57	Fair	Good.
169	Red Rife	Horrelville	66	73.4	12.95	51.0	32.38	10.24	3.16	9.63	0.76	Poor	"
166	Marquis	Ashburton	65	73.4	13.10	50.4	33.61	10.44	3.22	9.41	0.61	Fair	"
259	Quality White	Methven	64	75.2	13.35	49.4	29.74	9.15	3.25	9.25	0.60	"	"
172	Gold berry (Hybrid W)	Horrelville	64										
170	Queen Fair	"	65	72.8	13.48	48.0	32.27	9.93	3.25	9.00	0.50	"	"
256	Yandilla King	"	60	74.0	13.68	50.6	28.69	8.89	3.23	8.88	0.66	"	Fair.
155	Red Rife	"	61	72.7	13.03	50.6	29.26	9.13	3.21	8.75	0.71	Poor	Good.
160	Queen Fair	"	63	77.4	12.79	50.6	26.41	8.46	3.12	8.69	0.82	Good	Rather poor
260	Solid-straw Tuscan	"	65	72.1	13.43	48.4	30.50	9.30	3.25	8.63	0.58	"	Good.
157	"	Horrelville	62	74.0	13.24	50.6	27.65	8.69	3.18	8.56	0.66	"	"
258	Dreadnought	Ashburton	62	75.6	13.24	48.4	30.37	9.74	3.12	8.44	0.68	Fair	Fair.
156	Yecoman...	Horrelville	65	70.8	12.78	50.4	28.19	8.88	3.17	8.44	0.65	"	Fairly good
158	Major	Ashburton	62	75.2	13.27	48.4	27.71	8.57	3.23	8.25	0.68	Good	Rather poor.
161	Velvet Ngapara	"	64	74.1	13.56	51.0	27.81	8.92	3.12	8.25	0.60	"	Fair.
162	College Velvet	"	63	74.1	13.54	52.0	27.27	8.54	3.10	8.19	0.59	"	Good.
254	Stand Up White	Horrelville	70	72.4	13.50	50.0	30.74	9.37	3.28	8.13	0.58	"	"
152	College Hunter's	Ashburton	60	75.2	13.30	50.4	25.35	8.03	3.16	8.13	0.74	"	"
104	Solid-straw Velvet	"	58	74.3	13.88	48.4	25.88	8.15	3.18	8.13	0.66	"	Fair.
150	Essex Conqueror	"	64	71.5	13.22	49.0	27.44	7.75	3.54	7.69	0.51	Good	Good.
255	Red Marvel	Horrelville	60	74.7	13.14	50.0	25.44	8.08	3.15	7.25	0.67	Fair	"

Note.—All localities are in Canterbury—Horrelville in Eyre County, and Methven in Ashburton County.

to be good. Two samples of Jumbuck (W 168 and W 154) contained good amounts of protein; the gluten, although present in good quantity, appeared to be of rather poor quality; the water-absorption figures for the two samples were the highest recorded for either series. A sample of this variety tested in 1925 had an excellent capacity for water. White-straw Tuscan (W 171) gave a good yield of flour, and the protein content was well up to the average for the preceding three years; the gluten ratio was rather high. Of two samples of Red Fife, W 169 (Horrelville) contained a greater amount of protein than W 155 (Ashburton), although the quality of the gluten was fairly good in both cases. Marquis (W 166) contained a moderate amount of protein. This variety, together with Red Fife, has shown to better advantage in previous years, when both were classified as good strong samples. Quality White (W 259) was the best of the lesser-known varieties. Goldberry (W 172) gave a very good yield of flour, and contained moderate amounts of protein and gluten of fairly good quality. Queen Fair was represented by two samples (W 170 and W 160); the latter gave the highest yield of flour in this series, but the quality was inferior to that of the Horrelville sample. Two samples of Solid-straw Tuscan (W 260 and W 157) contained fair amounts of protein of good quality, the Horrelville sample being slightly the better. This variety and Dreadnought did not reach the standard of previous samples. Yeoman (W 156) gave a very good yield of flour, but appears to be rather variable in protein content. A sample from Lincoln in 1924 contained 7.94 per cent. protein, while in 1925 14.19 per cent. protein of fair average quality was recorded for an Ashburton sample. Major (W 158) also yielded a good amount of flour, but the gluten was of rather poor quality. The results for Essex Conqueror (W 159) are rather remarkable in view of the fact that this variety topped the 1925 samples with 14.69 per cent. protein, and was the best of the miscellaneous samples in 1924. The quality of the gluten in the 1925 sample was only medium, but the expectation that it would produce a loaf better than the average was fulfilled in the baking tests. The gluten in the present sample appeared to be of good quality. The ratio of wet to dry gluten was remarkably high.

1927 Series (Table 4).

The average protein content and the quality of these flours were on the whole considerably lower than in the preceding series. The outstanding varieties were Red Fife, three samples from Lincoln College (marked XI/27, XI/83, and XI/206 respectively), Goldberry (X/380), and Pearl. Marquis (X/366) contained a fair amount of protein, but the gluten was of poor quality, and the ash content very high. The three samples from Lincoln College (X 382, X 383, and X 384) were good all-round samples; the yield of flour was very good, and the protein of good quality; all three were characterized by a high ash content. Among the remaining varieties three samples of College Hunter's were of fairly good quality; X 369 (which gave the highest yield of flour in this series) had the highest protein content. College Velvet and White-straw Tuscan were of fair quality. A sample of Goldberry from Ashburton (X 370) was of rather poor quality. Yeoman II did not come up to the standard expected from the good yield and

Table 4.—*Chemical Analyses, 1927 Harvest Wheats.*

Laboratory No.	Variety.	Locality where grown.	Calculated Weight per Bushel	1 hour	Moisture		Absorption of Water		Gluten, Wet.	Gluten, Dry.	Ratio of Wet to Dry (Gluten)	Protein (N. x 6.25)	Ash	Colour of Experimental Flour.	Quality of Gluten by Appearance.
					Per Cent.	Per Cent.	Per Cent.	Per Cent.							
X			lb.		Per Cent.	Per Cent.	Per Cent.	Per Cent.				Per Cent.	Per Cent.		
377	Red Fife	Lincoln College	60	74.7	12.43	49.0	30.39	9.93	3.06	8.88	0.78	Poor	..		Good.
382	XI/27	"	64	76.6	12.32	48.0	28.92	9.47	3.05	8.88	0.83	Fair	..		"
383	XI/83	"	65	70.3	12.76	48.0	29.72	9.64	3.08	8.69	0.80	Poor	..		"
384	XI/206	"	64	74.9	12.49	50.0	29.16	0.57	3.05	8.38	0.82	Fair	..		"
366	Marquis	Ashburton	66	73.5	12.58	50.0	25.54	8.36	3.05	8.38	0.86	Poor	..		Poor
380	Goldberry	Lincoln College	65	76.8	12.66	48.4	30.39	9.75	3.12	8.31	0.59	Fair	..		Good.
44†	Mixture	"	..	73.5	13.20	48.4	28.48	9.17	3.10	8.13	0.57	Good	..		Rather poor.
419	Pearl	Lincoln College	66	73.8	13.15	51.6	28.24	8.80	3.21	8.00	0.53	..	..		Good.
372	Velvet x Solid-straw Tuscan	Ashburton	62	71.9	12.46	47.6	20.74	6.91	3.00	7.96	0.71	..	..		Very poor
369	College Hunter's (Control)	"	63	77.7	13.20	49.0	24.39	7.92	3.08	7.96	0.66	..	..		Fair
374	College Velvet	"	64	74.0	13.91	49.4	23.69	7.68	3.08	7.81	0.61	Fair	..		"
375	Yeoman II	Lincoln College	63	76.4	13.16	49.0	24.20	7.71	3.14	7.69	0.70	..	..		Rather poor.
421	Tuscan	"	66	72.3	12.74	49.6	27.92	8.55	3.27	7.09	0.50	Good	..		"
378	College Hunter's	"	62	72.5	13.19	49.0	22.76	7.20	3.16	7.00	0.60	..	..		Fairly good.
381	White Fife x Benc facti 2	"	62	74.8	13.66	48.4	22.01	7.20	3.06	7.63	0.62	Fair	..		Poor
420	Victor	"	65	75.2	12.00	49.0	24.45	7.73	3.16	7.63	0.58	Good	..		Rather poor.
373	College Hunter's, 1926	Ashburton	64	73.5	13.27	47.6	22.67	6.92	3.28	7.44	0.57	..	..		Fairly good.
361	Solid-straw Tuscan	"	63	74.3	14.00	49.4	22.97	7.40	3.11	7.44	0.64	Fair	..		Rather poor.
418	Hunter's	Lincoln College	64	70.8	12.78	49.6	24.66	7.65	3.22	7.44	0.62	Good	..		"
367	Essex Conqueror	Ashburton	64	75.0	13.31	49.6	23.70	7.23	3.28	7.38	0.54	..	..		"
371	White-straw Tuscan	"	65	74.9	13.51	47.0	22.68	7.06	3.21	7.31	0.63	Fair	..		Fair.
370	Goldberry	"	63	77.6	13.76	48.4	21.73	7.11	3.06	7.25	0.60	Good	..		Rather poor.
365	Queen Fair	"	64	76.6	14.06	49.0	17.71	6.04	2.93	7.00	0.91*	..	..		Poor.
364	Major	"	64	77.1	12.75	49.6	19.39	6.07	3.10	6.88	0.71	Good	..		"
379	Bell	Lincoln College	58	73.4	12.75	49.4	22.76	7.04	3.23	6.69	0.62	..	..		"
376	Biffen II	"	60	75.8	12.80	48.6	17.96	5.46	3.29	6.38	0.65	..	..		Very poor.
363	Trifolium 14	Ashburton	60	76.4	13.47	47.0	19.91	6.32	3.15	6.38	0.52	..	..		Poor.

* First sample milled—contamination from mill
 Note.—All localities are in Canterbury—Lincoln in Springs County.

appearance of the flour. The reputation acquired by Victor of always giving a good yield of flour but failing in quality was borne out by the results for the sample tested (X 420). Three little-known varieties--Bell, Biffen II, and Trifolium 14--were of poor quality.

Summary and Conclusion.

The average protein content of the 1926 series flours was 9.0 per cent., compared with 7.7 per cent. for the 1927 series. The averages for the three districts represented were as follows :--

1926 -				Per Cent.
Horrelville	..	..	..	9.3
Ashburton	..	..	..	8.6
1927 -				
Lincoln	..	..	..	8.0
Ashburton	..	..	..	7.4

A comparison of the results obtained for the same variety of wheat grown in two different districts (1926 harvest) is presented in the following table :--

Variety.	Ashburton			Horrelville.		
	Protein.	Gluten.	Ash.	Protein.	Gluten.	Ash.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
College Hunter's..	8.13	8.03	0.74	11.25	12.37	0.69
Jumbuck ..	10.75	11.49	0.72	11.06	11.17	0.63
Red Fife ..	8.75	9.13	0.71	9.88	10.78	0.57
Queen Fair ..	8.60	8.46	0.82	9.00	9.93	0.56
Solid-straw Tuscan	8.50	8.69	0.66	8.63	9.39	0.58

It will be seen that in every case Horrelville produced a wheat of better quality than Ashburton. It is noteworthy that the ash content of the Ashburton samples is consistently higher. Sufficient data for a similar comparison of the 1927 wheats were not available, but it has been shown above that the average protein content for Ashburton was lower than that for Lincoln.

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- (1) Kent-Jones, D. W. : Some Observations on the Washing of Gluten from Flour. *The Analyst*, 1927, 617, p. 439.
- (2) Kent-Jones, D. W. : A Numerical Expression for the Colour of Flour. *The Analyst*, 1927, 617, p. 443.

(Series to be continued.)

Importation of Animal-manures.—Supervision of the sterilization of animal-manure consignments in Australia and India was continued under the direction of the Live-stock Division during the past year. The quantity of such manures imported into New Zealand has for some years been declining, but the importations from Calcutta during the past year (1,650 tons) show an advance. The importations from Australia amounted to only 215 tons. Increasing cost of production in the Commonwealth is said to be largely responsible for the falling-off.

GOATS AND NOXIOUS-WEEDS CONTROL.

ELIMINATION OF BLACKBERRY, GORSE, AND BRACKEN ON A TARANAKI FARM.

R. WRIGHT, Principal Inspector, Live-stock Division, Wellington.

A MOST practical and successful demonstration of the complete elimination of blackberry, gorse, and fern by means of goats in conjunction with heavy stocking, chiefly with sheep, has been given by Mr. E. J. Carthew, of Barrett Road, near New Plymouth. This work—which has been under departmental observation for some years—has resulted in the conversion of a blackberry and gorse infested holding of 131 acres into one of the cleanest farms in the district, and its maintenance in a weed-free condition during the past three years. The outstanding feature in connection with this matter is the fact that the land is being and can be permanently maintained in its present clean condition at extremely small cost, while its stock-carrying capacity has immensely increased.

When the holding was acquired by its present owner its carrying-capacity was some thirty cows, while during the past three years or more the farm (of which an area of about 100 acres is in pasture and the remainder in bush, &c.) has carried a flock of sheep numbering six hundred wethers during the summer months, with reduction to four hundred during the winter season, as well as several horses and a score or more of cattle. This is in addition to the goats, some two hundred of which were kept on the place for the first year or two. At the time of my latest visit of inspection, in January last, the number of stock on the farm was six hundred wethers, eight horses, twenty-three cattle, and forty goats, all of which had been grazing for some months on the 100 acres of pasture.

A systematic inspection of the entire holding has been made on each visit. On the first occasion, within two years of Mr. Carthew's entry into possession of the property, it was found that the old growth of blackberry, gorse, and bracken fern was apparently dead; a subsequent inspection confirmed this view, it being found that all such growth was down and had been burnt, the old stems and root-crowns being then completely dead and the crowns covered with an abundant sole of grass. Odd seedlings of both blackberry and gorse continue to make their appearance in many places, the ground yet being well supplied with seed from the past heavy infestation, and it is necessary to still keep a few goats (now limited to forty) on the farm to destroy these seedlings as they appear—which work the goats attend to most effectively.

Though I had not seen the area before the attack on the noxious weeds commenced, there was on my first visit clear evidence that practically the whole of the 100 acres of bush-free country on the place had been infested with blackberry and gorse, with some fern—but chiefly with blackberry. Mr. F. W. Sutton, Inspector of Stock, New Plymouth, who has an intimate knowledge of the district generally and of this farm in particular, states that when acquired by the present owner the property was so overrun with noxious weeds that

its value had been lowered in a few years by more than 50 per cent. Its present enhanced value is due to the effective riddance of the noxious weeds and consequent regrassing of the cleared areas, and not to any general rise in land-values in the locality.

On acquiring the farm the present owner made an attempt at hand-clearing, but found this a very slow and costly method, without any guarantee that the cutting and grubbing would have a permanent effect. The land is of a broken and ridgy nature, intersected with steep faces and gullies, and is therefore to a great extent unploughable; thus control by means of tillage could not be adopted. This being the case, after having cleared and burned the roughage of gorse and blackberry on some of the more accessible portions of the ridges, a change in plan of operations was made. It was decided to try the effect of a large herd of goats, commencing, as already stated, with two hundred of these animals. The method adopted was to first put on in one paddock forty or fifty cattle for a day to clean up any grass roughage and trample down some of the growth of rough weeds. As the cattle were moved on to another paddock several hundred sheep were brought in immediately following for one day, and as they in turn were moved a paddock farther on the goats were brought in to the first paddock (by then bare of all pasture) to get to work on the blackberry and gorse, &c. This process was continued through the whole series of paddocks—first cattle, then sheep, then goats, one following the other from paddock to paddock day after day and month after month.

After some preliminary experience Mr. Carthew found that for early success small paddocks were essential, and the farm was then further subdivided into fifteen paddocks. A regular routine was followed of moving the stock forward one paddock each day, the four hundred to six hundred wethers, together with a number of cattle, being followed one day behind by the herd of two hundred goats. Each paddock had fourteen days' spell before the stock again got round to it, and there was therefore a fair growth of fresh young pasture, &c., for the cattle and sheep in each field as it was reached, but little or none for the goats following after. These animals therefore made a severe attack on the weeds, with very effective results. The good work of the goats was early apparent, and in a very short space of time it was evident that the complete elimination of all noxious plants was assured.

After carrying on this system for some time Mr. Carthew decided to run all the stock together, with the usual daily shift of one paddock ahead, and he states that the results of this later method were equally satisfactory. On the farm to-day there is not a blackberry-vine nor a gorse-bush to be seen, all having been cleared out of even the steepest and most inaccessible creek-beds.

Mr. Carthew firmly holds that there need be no separation of the goats and sheep—that there is no need to have the goats following one paddock behind the sheep. My own opinion, however, is that better results and earlier riddance of blackberry, &c., will be effected by having each paddock eaten bare of pasture before the goats are turned in, as then they must devote the whole of their feeding to the vines and shrubs, there being practically nothing else left for them.

The subdivision of the area into smaller paddocks was done by the erection of temporary fences, all the lower wires being barbed. Barbed wire was also put round the boundary-fences of the farm in order to confine the goats to their own domain. The goats were obtained at an average price of about 5s. each, the total cost of the two hundred being about £50, and this expenditure was recouped to the owner by additional profits from the sheep in a very short space of time. Contrary to expectations, the sheep were found to keep in excellent condition, many being fit for the butcher; each autumn, as a matter of fact, a fair draft of fat wethers has gone from the farm to the meat-freezing works. The wool-clip has also been very satisfactory, and though damage to the fleeces from the barbed wire fences might have been expected there was no evidence of any injury from this cause.

Good fences are essential to success, and experience has proved to Mr. Carthew that wether goats are the best workers, though a certain number of nannies and billies require to be kept to maintain the supply of goats, unless they can be cheaply obtained from outside. Mortality among the kids is heavy when the goats are being continually moved. For breeding purposes the proportion of the sexes is much the same as with sheep—one billy to forty or fifty nannies.

Mr. Carthew proposes to top-dress the farm with fertilizer at an early date, and if this is done its carrying-capacity should be still further improved, though it is hard to imagine much increase on the quantity of stock now carried.

THE CATTLE-TICK POSITION.

THE incidence of the cattle-tick (*Haemaphysalis bispinosa*) in the Dominion during the past year is dealt with by the Director of the Live-stock Division (Mr. J. Lyons) in his annual report for 1926-27 as follows:—

The infestation of stock with cattle-tick within area A, with the exception of the Tauranga and Coromandel districts, has been much lighter than for some years past. The cold season experienced may account for this to some extent. There are, however, other factors at work, such as picking and spraying. It is also realized that better farming methods, such as top-dressing, keeping the roughage eaten out, ploughing, and burning, are all factors which assist in reducing the ticks to a minimum. The hearty co-operation of settlers is asked for in this respect. If owners will individually see that their stock is kept free from ticks, and that their pastures are kept free from roughage, which affords a breeding-ground for the tick, it will go a long way towards the eradication of the pest. Where dairying is carried on, the method of control is comparatively simple. It is on the grazing-runs, where stock are seen only at irregular intervals, that difficulty is experienced. However, much may be done in the latter case by occasional dippings, and also in destroying all roughage on the farm. In area B the position is better than it has been for several years. Very few fresh farms were infested, and in the majority of farms where ticks were found on stock in previous years none was found. The position at Waitara has improved, only a few ticks were found this season, and those all on properties previously affected. A constant inspection of all cattle within the area has been maintained, and all cattle within the area have been dipped or sprayed before removal. It is to be regretted that during the season a further development took place regarding cattle-tick in the Poverty Bay district. Ticks were reported on several properties in an area adjacent to Tolaga Bay. Every endeavour was made to locate and eradicate the parasites in this district. Regular inspection of all neighbouring stock was carried out, and spraying and burning of cover were resorted to, and it is hoped that by these means the tick will be eradicated.

CONTROL OF VINE DISEASES AND PESTS OCCURRING IN NEW ZEALAND.

J. C. WOODFIN, Vine and Wine Instructor, Horticulture Division.

THE object of this article is to assist the vine-grower in distinguishing the principal fungous diseases and insect pests of the vine present in New Zealand, in avoiding conditions favourable to their development, and in controlling them when present. The treatment advised is subject to modification by the experienced vigneron to suit the climatic and general conditions of his particular district and the severity of attacks. While in many cases control is of value, the vigneron's slogan in regard to these troubles should be "prevention."

1. FUNGOUS DISEASES.

Oidium or Powdery Mildew (*Uncinula spiralis*).

Oidium is well known throughout the viticultural areas of New Zealand, where it causes losses in both vineyards and vineries. Few of the European vines are proof against the attacks of Oidium; American varieties are more resistant—some quite so, and hybrids more or less so.

This fungus attacks all the green parts of the vine. Its mycelium, unlike that of downy mildew and anthracnose, develops on the outside of the organs of the vine, and is furnished with suckers to extract its food. The mycelium is therefore exposed to the direct effects of fungicides, which makes its control a comparatively easy matter. The fungus develops in warm, humid, cloudy weather, often when this follows a sudden spell of cold. Any atmospheric condition which causes a limp condition of the foliage weakens its power of resistance (see this Department's Bulletin No. 102, "Vine-culture under Glass," page 26). Vines growing on pergolas, on high trellises, against walls, and in low or sheltered spots in the vineyard are more liable to be affected than those trained on low trellises or on slopes or hillsides. Vines with soft luxuriant foliage, due to an excess of moisture or nitrogenous manure, are especially vulnerable.

Oidium makes its first appearance on the young leaves and shoots as small whitish patches. These appear on both sides of the leaves, and if not checked will extend and cover the whole surface and eventually destroy the leaves. The mycelium and the myriads of conidiophores which cover the leaves give them the appearance of having been freely powdered with a fine greyish-white powder—hence one of the names by which the fungus is known. If this powder is rubbed off the leaf a dirty green surface, dotted with small brown specks, is exposed. A distinctly mouldy odour always accompanies the fungus.

The young shoots when badly affected fail to develop, turn brown, and are easily broken off. If the bunches are affected in their early stages of growth the flowers fail to set, or the young fruit if formed is destroyed. Later the berries become covered with a felt-like mould, which when it falls off leaves the skin hard and liable to burst. Many

of the berries do so, splitting down one side and exposing the seeds and pulp to view, thus giving free access to fungi and insects. The grapes are not resistant to *Oidium* until they begin to colour.

Preventive Treatment where Oidium is endemic.—Dust the vines with very fine sublimated or precipitated flowers of sulphur—not ordinary



FIG. 1. OIDIUM OR POWDERY MILDEW AFFECTING LEAVES AND BERRIES.

[From "*Les Maladies de la Vigne*."]'

ground sulphur—having a velvety feel free from grit, adding one-third its volume of sifted air-slaked lime, or, better still, fresh quicklime hydrated by adding water to it in the proportion of 1 gallon to 30 lb. lime—(1) when the shoots are from 4 in. to 6 in. long, (2) when the blossoms are open, (3) when the grapes attain one-third of their size.

This programme can be modified to suit climatic conditions and the virulence of the attack. The sulphur can be applied at any time of the day, excepting during hot sunshine, when there is a danger of burning the foliage. Use should be made of the direction of the wind to keep the sulphur away from the eyes as much as possible, and the vigneron should avoid rubbing his eyes. If notwithstanding all precautions the eyes feel sore, all sulphur should be carefully removed from the face and the eyes bathed in a solution of bicarbonate of soda, boracic acid, or a little sweet milk.

Sulphur acts as a preventive and a slow cure for Oidium. As a preventive it should be applied, at the latest, when the faint whitish spots begin to appear on the foliage. Where the Oidium has become well established on the vines a solution of permanganate of potassium, which destroys all mycelium and spores it comes in contact with, should be applied for immediate results. To make the solution $1\frac{1}{2}$ lb. permanganate (or Condy's crystals) is crushed to a fine powder and dissolved in about 2 gallons of hot water, and when thoroughly dissolved (which takes some time) the volume is increased to 100 gallons with water. The mixture should be made in a metal container. Wooden containers should not be used, with the exception of those previously used for preparing bordeaux mixture. The concentrated liquor is very corrosive, and should be handled with care, or severe burns will result. Permanganate is effective when mixed with bordeaux, on condition that the latter is free from spreaders. When mixed with water an addition of 30 lb. of fresh quicklime renders the solution more adhesive to the berries. The permanganate solution should be applied through a nozzle giving a fine mist spray, and at a sufficient distance from the vines to allow the liquid to spread out.

The fumes of sulphur which control the Oidium are not very effective when the temperature is below 90° F.—a condition which is usual in our climate. For this reason it will often be found advantageous in cool weather to use lime-sulphur solution, in which the more finely divided forms of sulphur are quicker in their action than those of the dry form of sulphur. Some of our leading vignerons have entirely discarded the use of dry sulphur in favour of the lime-sulphur solution, and obtain a satisfactory result with a weak solution of 1 part of commercial lime-sulphur in 100 parts of water, applied at the same periods as dry sulphur would be, with the exception that it is not used during the blossoming-period, but just before the flowers open. Dry sulphur assists the fruit in setting, whereas the liquid form has a contrary effect.

Downy Mildew or Peronospera (*Plasmopara viticola*).

This fungus (a recent arrival as regards vine-growing in New Zealand) develops under conditions of heat and humidity in the late spring or early summer, and is usually observed about seven days after rain, fog, or heavy dew followed by a warm sunny day. Under favourable conditions fresh outbreaks recur throughout the season, and may destroy the whole crop and jeopardize the crop of the following season.

Downy mildew destroys the young shoots, leaves, and flowers or berries, and attacks and damages the more matured leaves and berries.

It can easily be distinguished on the leaves, on the upper surface of which it forms irregular separate or merging spots, varying in colour from light yellow to reddish-brown, with corresponding areas on the under-side covered with an efflorescence resembling hoarfrost. This efflorescence does not develop under very dry conditions, and as it is

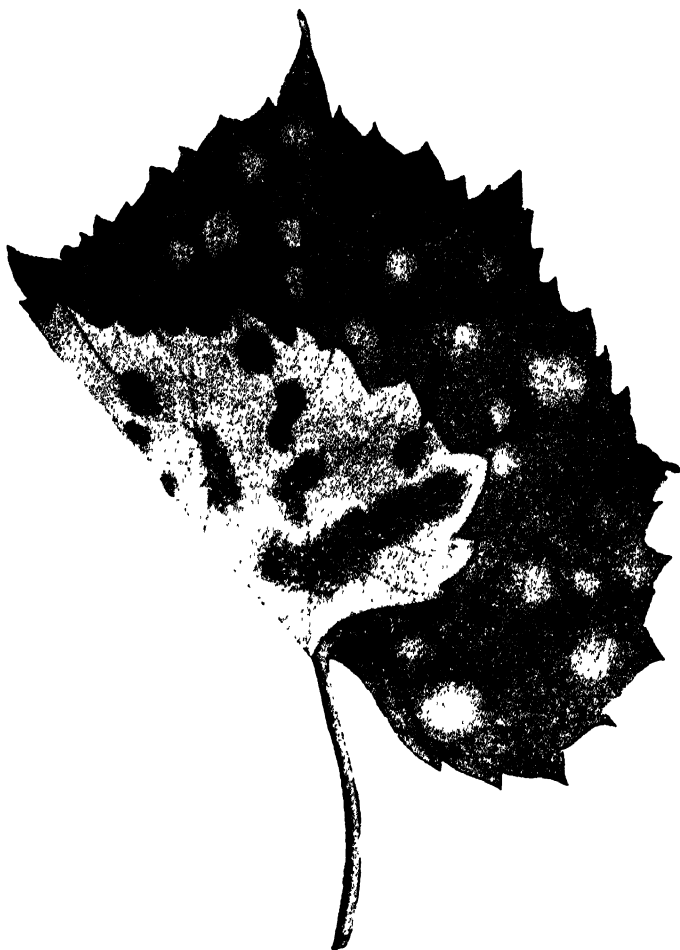


FIG. 2 VINE-LEAF ATTACKED BY DOWNY MILDEW.
Showing appearance of leaf on upper and lower surfaces.

[From United States Farmers' Bulletin 1220.]

composed of fruiting-organs the spots remain sterile. The young green shoots when attacked by downy mildew show spots like those on the leaves, but less easily distinguishable. Later the shoots take on a dark-brown colour and break off with the slightest touch.

In the bunches, before or just after the fruit is formed, the stalks become black and the flowers or the fruit fall off. If the fungus

arrives a little later the berries are covered with a greyish-white down, and soon dry up. When larger, the berries take on a reddish-brown colour and fail to ripen. The fruit is not safe from the fungus until the berries begin to colour, but the quality of the juice can still be affected by the action of the fungus on the leaves.

The treatment is essentially preventive. In normal seasons spray with a 2-per-cent. bordeaux or burgundy mixture (2 lb. sulphate of copper to 10 gallons water, with just sufficient *fresh* lime or soda to neutralize the acidity) during the critical period—that is, up to the time the berries are about half-grown—followed by a weaker spray of 1 to 1½ per cent. strength. Last season (1926–27) a few vignerons used a 3–4–50 bordeaux in the early part of the season, which was particularly favourable to the development of fungous diseases, instead of a 2-per-cent. or 3-per-cent. mixture, and suffered considerable losses in consequence.

The spray should be applied as follows: (1) As soon as possible after the buds break; (2) before the flowers open; (3) when the petals have fallen; (4) fourteen days later, or as required, in seasons favourable to the development of the disease. Young shoots and bunches of flowers and young grapes should be well covered and penetrated with spray. To ensure the adhesion of the spray to the bunches the addition of a spreader is necessary on account of the waxy nature of their surface. In seasons favourable to downy mildew fresh applications of bordeaux should be made to the newly-grown leaves as they appear, while there is still a residue of former treatments on the vines. To permit of the spray penetrating to all the green parts of the vine, and to facilitate their drying quickly after rain or fog, disbudding, tying up, and topping should be executed as soon as the growth of the vines warrant these operations. All weeds should be kept down, and the driest conditions possible aimed at.

In districts where the fungus has made its appearance the first three sprays may be considered to be essential, and the strength of the bordeaux can be increased and the spray applied more often in cases of virulent attacks, or where the spray has been washed off by the rain. It is essential that a complete armour of copper salts should cover the growing organs of the vine. The young vines in the nurseries should not be neglected, as they are even more susceptible to the disease than the older vines.

For table grapes nearing the ripening stage bordeaux can be replaced by a spray composed of 2 lb. of verdigris dissolved in half a gallon of water and completed with water to 22 gallons. This is quite as effective as bordeaux, and will not mark the grapes.

The life-history of downy mildew is given in the Department's Bulletin No. 127, which may be obtained free on application.

Anthraxnose or Black-spot (*Maginia ampelina*).

Anthraxnose develops in the late spring and early summer under warm and humid conditions. It is also known as the "bird's-eye rot," which aptly describes the appearance of the round spot on the berry, with its rosy-grey centre and dark edges.

On the leaves small reddish-brown spots form and dry out, leaving an irregular hole with a black border. Small black spots, growing to

elongated sunken areas, rosy-grey with a dark border, extend along the stalks of the leaves and young shoots. A number of these cankers forming on the same leafstalk or shoot is liable to destroy it completely, and if the disease is allowed a free course the vine will become stunted and eventually die. Several spots forming on one berry may cause it to fall. One or two are sufficient to cause the berries to split and allow decomposition to set in, and this is how the greatest loss is generally caused.



FIG. 3. FEATURES OF ANTHRACNOSE OR BLACK-SPOT.

[From "*Viticulture Moderne*,"

Treatment.—About fifteen days before vegetation starts—when the buds are beginning to swell—spray with 2-per-cent. bordeaux, taking care to cover thoroughly the previous year's growths. It is from the old cankers of these that the new green growths are liable to become infected. Spray again with a 1-per-cent. bordeaux when the young shoots are 3 in. or 4 in. long. Further applications of bordeaux can be made if the disease is making any progress, before flowering and after the fruit is set, and again fifteen days later. The danger of infection ceases when the berries begin to colour.

Grey-rot (*Botrytis cinerea*).

Very humid conditions are essential for *Botrytis* to develop sufficiently to become dangerous in the vineyard. Under favourable conditions this fungus attacks the foliage and young fruit of the vine in the early part of the season, and later when the grapes are colouring. Ideal conditions for its development are frequently observed in

vineries where there is an excess of foliage on the vines, combined with a damp steamy atmosphere owing to want of ventilation. In the Auckland district the fungus occasionally develops in the best regulated houses, owing to persistent muggy atmospheric conditions outdoors.

In the vineyards the attacks are usually observed in the autumn, but last spring and early summer (1926-27), during which climatic conditions were abnormal in the Auckland district and exceptionally favourable to the development of fungous diseases, a number of early infections were brought to my notice. In the early part of the growing season *Botrytis* makes its appearance as small yellow spots on the leaves. These spots extend gradually, and eventually become covered with the characteristic grey mould. The green parts of the young shoots offer an exceptionally favourable medium for the development of the fungus, and as a result are quickly killed. The green bunches may be affected at any point, and if it happens to be at the stem the whole bunch will be lost. Spots form on the young berries similar to those on the leaves, and spread very quickly if weather conditions continue to be favourable.

Later, as the lignification of the young growth proceeds and becomes more resistant, the fungus does not affect the vine until towards the end of the season when the grapes are colouring, and then only if continual rains or persistent fogs become the order of the day. The excessive moisture swells the berries, and the extended skin cracks, allowing the juice to exude and spread over the berries. This offers an ideal medium for the development of the fungus, which quickly covers the surface with fluffy grey mould, generally accompanied with *Penicillium* and other moulds. When the berries do not crack they become soft, covered with mould, and eventually shrivel up to mummies which, with the young wood, help to carry the fungus over the winter in the form of small black nodules or sclerotia.

If the grapes are attacked when nearly ripe, and there is no hope of controlling the fungus, they should be gathered at once and the juice fermented apart from the skins and made into white wine (in the case of black grapes), as a few days' delay may mean the loss of the whole crop. The juice should be separated from the berries as quickly as possible, and 6 oz. of metabisulphide mixed in hot water in a wooden or enamel vessel added to each 100 gallons of the must. This will exterminate all undesirable ferments and destroy the oxydase, which is the cause of "brown casse" in red wines and the yellowing and browning of white wine. When the must has reposed for forty-eight hours draw off the clear liquid into vats or barrels. Add a little fermenting must from a starter prepared for the occasion from sound grapes, and $1\frac{1}{2}$ oz. of tannic acid per 100 gallons. When racking later run the wine into well-sulphured containers. Crops that have suffered badly from downy mildew and *Oidium* should be treated in the same manner.

It is an interesting fact that this undesirable rot under ordinary conditions is welcomed in some of the European viticultural districts—Sauterne, Rhine, and Anjou—where the principal varieties, Sauvignon, Semillion, Muscatelle, Riesling, and Chenin Blanc, which have resistant skins, are grown. In these districts, where a dry autumn

is the rule, the fungus, by diminishing the thickness of the skin, allows some of the water of the grape to evaporate, and at the same time develops a particular aroma which is considered desirable in this class of wine. Under these conditions the fungus is known as *pourriture noble* (noble rot).

Treatment.—The effect of the damp conditions under which *Botrytis* develops should be reduced as much as possible by suppressing useless foliage and keeping the vines open and exposed to the drying effects of any breeze that comes along. The drainage should be good. In planting new vineyards choose a slope facing the north or north-east ;



FIG. 4. GREY-ROT OR BOTRYTIS CINEREA.

Left, noble rot ; right, common rot—both in advanced stage.

[From "Cours d'Oenologie."]

avoid gullies and hollows. Late close-bunched varieties can be protected to some extent by stripping all the leaves off the vine below the bunches when the berries begin to colour, which will also advance the ripening. In table varieties thinning the berries of the bunches is recommended.

The appearance of the disease in the early part of the season has been rarely recorded in New Zealand, and viticulturists in other countries, as far as I can ascertain, have not yet found a reliable control. There is, however, a general preference for powder over liquids, and out of the many proposed remedies the following dry mixtures (the ingredients of which can be readily procured in New

Zealand) might be tried: Lime, air-slaked or hydrated (see control of *Oidium*), half of each; or 85 parts of hydrated lime and 15 parts of finely pulverized Condry's crystals (permanganate of potash). When dusting the vines special care should be directed to giving the bunches a good covering.

Root-rot or Pourridie of the Vine.

The roots of the vine are subject to injury through excessive moisture, from insects which feed on them, from fungi and bacteria which obtain entrance through the holes made by the insects, through faults in imperfect unions on grafted vines and accidental wounds, and from other causes. In their weakened non-resisting condition the roots form an easily invaded favourable medium for the development of that class of fungi which seem to have the special mission of reducing wood to earth again. These fungi seem to be universal, but their presence is especially noticeable in areas recently covered with bush, where there is generally plenty of rotting wood, roots, &c. The mycelium of the root-rot fungus spreads through the soil and enters the vine from the smaller roots, gradually working up the main roots to the surface, causing destruction on its way.

The first sign of the effects of root-rot is an abnormal crop of grapes, followed by a weak stunted growth of the young wood, with undeveloped leaves. The vine is starving from want of nourishment from the roots, and soon dies.

When the disease is well advanced the vine can be easily pulled out of the ground; on examination the roots will be seen to be black and rotten, and if broken a viscous liquid will exude. On lifting the black bark a number of white branching filaments will be noticed running up to or above the soil-level. (An interesting account of root-rot in New Zealand will be found in "Fungous Diseases of Fruit-trees," by Dr. G. H. Cunningham, Mycologist to the Department of Agriculture.)

Treatment.—The root-rot fungus generally spreads from the first vine affected to adjacent vines, and on account of its subterranean habits is very difficult to control. The vines that show the slightest sign of being affected should be dug out with their roots and burnt on the spot, and the soil disinfected with 1½ oz. per square yard of commercial carbon bisulphide inserted in three or four holes 1 ft. deep in each square yard. The holes can be made with a dibble or Vermorel's forcing-syringe (*pal Vermorel*), and, after the disinfectant has been poured into them, covered with earth. The ground can then be sown with crops for three or four years, then treated again with carbon bisulphide, and replanted with vines. The expense of the treatment with carbon bisulphide would be justified only under special circumstances.

In planting a vineyard on recently cleared bush or orchard all stumps and roots should be carefully extracted, and, together with all other fragments of wood, burnt or disposed of elsewhere. All wet spots should be carefully drained, and posts used for supporting the wires should have their ends charred or tarred before placing them in position so as to prevent rotting.

Crown-gall or Broussin of the Vine.

This disease is caused by the bacterial organism *Pseudomonas tumefaciens*. The tuberous growths generally form just above soil-level on European varieties, and are sometimes very large. On American vines they appear as small, numerous, wart-like galls in elongated masses along the trunk and main branches.

Treatment.—Remove the growth with a knife, and paint the wound with a saturated solution of sulphate of iron in cold water, 3½ lb. to the gallon.

2. INSECT PESTS.

Phylloxera (*Phylloxera vastatrix*).

Phylloxera is the most dreaded insect enemy of the vine. It was reported in New Zealand in 1885, and has since spread over the Auckland Peninsula from Auckland City to the North Cape. The insect goes through a number of metamorphoses, and its life-history varies with the climate and the variety of vine it is living on. On European vines and American-European hybrids it is found principally on the roots and rarely on the leaves. The leaf form is found on the American and hybrid varieties. The leaf or gallicole form of the insect (if it exists in New Zealand) has not been reported as doing any damage, but the radicole or root form has exterminated most of the vines in vineyards and vineries in North Auckland wherever the vines were not established on resistant stocks.

Phylloxera can be disseminated by transporting grafted vines or vines on their own roots from infected areas to clean areas (which is prohibited, and for which heavy penalties may be incurred), or by a female form of the insect which develops long wings in the summer and with the aid of the wind is carried long distances. In vineyards or vineries the insect migrates from one vine to another through the soil. It can just be seen on the roots with the naked eye, but better with a magnifying-glass, in several of its forms, yellow and orange in colour.

The leaves on affected vines become yellow, the grapes fail to ripen, and the general appearance is like that of vines attacked by root-rot. The condition of the roots, however, differs. On examination a number of nodules shaped somewhat like birds' heads will be found on the rootlets, and tuberous swellings on the more matured small roots. These nodules and swellings form where the radicole form of the insect has punctured the bark with its rostrum to extract food. They form in spring and early summer, and rot in autumn and early winter, finally killing the roots. The vine defends itself by throwing out new rootlets and by forming new bark, but the fight is an unequal one, and the plant generally succumbs in from three to four years. The vines resist the longest in rich loose soils, where the plant can throw out roots freely. On sandy soils the phylloxera is unable to exist on the roots, and in them ungrafted vines are safe from its attacks. ■

Control.—The insect can be controlled by injecting carbon bisulphide into the soil, but the effects are only temporary, and this method is now generally abandoned in favour of grafting the vines on American or hybrid phylloxera-resistant stock. The phylloxera can live on the

roots of these stocks, but they do not increase so rapidly on them, and the punctures they make cause comparatively little injury.

The best phylloxera-resistant stocks obtainable have been introduced from time to time by the Horticulture Division, and are to be had from nurserymen or from the Te Kauwhata Horticultural Station. Intending planters are invited to consult the Division as to the choice of stocks to suit the soil on which they intend planting, and as to their affinity to the scion varieties to be grown.

Caterpillars.

The chief culprit among the caterpillars has been identified by Mr. David Miller, the Agriculture Department's Entomologist, as the common leaf-roller, the larva of the oblique Tortrix (*Ctenopseustis obliquana* Walk.). The Tortrix family includes two of the worst insect pests of European vineyards, the Cochylis (*Tortrix ambiguella*) and Pyrale (*Tortrix pilleriana*). It therefore behoves us to keep our member of the family within bounds. It has already caused considerable loss to the table-grape growers at Te Kauwhata during the last two seasons.

Control.—Spray with arsenate of lead, $1\frac{1}{2}$ lb. paste or $\frac{3}{4}$ lb. of powder to 50 gallons water (2 oz. paste or 1 oz. powder to 4 gallons water), (1) when the young shoots are 6 in. long or as soon as the young caterpillars are observed, (2) when the fruit has set, (3) a fortnight later. If spraying with bordeaux or lime-sulphur, combine the arsenate of lead with them. To the lime-sulphur add $2\frac{1}{2}$ oz. of casein per 50 gallons; mix the casein in a quart of water; slake $2\frac{1}{2}$ oz. of lime slowly, and increase the quantity with water to a quart; pour the lime water slowly into the casein, stirring well, and pour the mixture into the water, again stirring well, then add the concentrated lime-sulphur and arsenate. *Avoid using arsenate when the flowers are in bloom, on account of the risk of poisoning bees.

For destroying the caterpillars nearer ripening-period use Black Leaf 40, 1 in 1,200 ($\frac{1}{2}$ pint in 75 gallons, or $\frac{3}{4}$ pint in 100 gallons of water or bordeaux).

Mealy bug (*Pseudococcus adonidum*).

The mealy bug is an occasional visitor to the vineyards in New Zealand, and increases very rapidly if undisturbed.

Control.—After pruning the vines and burning the prunings strip off all the old bark and spray with lime-sulphur, 1-8.

Bronze-beetle (*Eucolaspis brunneus*).

This small brown beetle generally appears in December, and attacks the young growths, generally the stems of the bunches. The greatest damage has occurred in vineyards where the vines were grown on the telegraph system—three horizontal wires—and under which the ground was left undisturbed. In well-cultivated vineyards the damage done by this beetle is insignificant.

Greater Vine-scale (*Lecanium berberidis*).

This is a large brown oval scale usually found on the wood of the previous season's growth of the vine.

Control.—In winter burn the prunings and apply lime-sulphur, 1-8. In early summer watch for the young emerging. They are pale yellow in colour, and should be destroyed whilst still soft with Black Leaf 40, $\frac{1}{4}$ fluid oz. in 4 gallons of water in which 2 oz. of soap has been dissolved.

NOTE.—The methods of treatment and control of diseases and pests affecting vines more particularly in vineries are dealt with in the Department's Bulletin No. 102, "Vine-culture under Glass," supplied gratis on application.

MINERAL CONTENT OF PASTURES.

IN his annual report for 1926-27 Mr. A. H. Cockayne, Director of the Fields Division, makes the following remarks on this subject:—

It would appear that most of the work performed in Great Britain and elsewhere on the mineral content of pastures has for its objective the determination of definite mineral deficiencies that lead to definite malnutrition of stock. This work also is of importance to New Zealand, but doubtless it should form but a part of a larger and fuller scheme that has for its objective the total nutrient content of pasture herbage.

The determination of the nutrient content of the constituent species of pastures is important mainly from four aspects: (1) From the point of view of formulating the highest potential food-value pasture mixture possible to secure on each soil-type; (2) from the point of view of determining the optimum milk-producing life-form stages, as distinct from the non-milk-producing life-form stages, fattening and non-fattening life-form stages, of the herbage of the component species of the pasture on each soil-type; (3) from the point of view of determining nutrient (including mineral) content alterations that occur on top-dressed land; (4) from the point of view of determining on certain soil-types mineral deficiencies that result in definite stock malnutrition.

Before we can really claim to be in the best position possible we must know the species thoroughly—(1) morphologically, (2) ecologically, and (3) chemically. Determination of relative nutrient content will help towards maximum efficiency in regard to mixture formulæ. The determination of nutrient content at different stages in the life-form of the individual should throw much light on why certain farm practices are preferable to others. The stage of growth underlies a fundamental principle in pasture-management, and virtually the whole of efficient pasture-utilization has for its objective the maintaining of the pasture herbage in that condition of growth that stock produce their best when grazed upon it. In other words, there is a stage in the growth of all species when nutrient content is at a maximum. The determination of this maximum point by chemical analysis would be of infinite value towards directing pasture-management on the best possible lines.

The part played by top-dressing in providing a better-balanced mineral ration to stock may be to some extent measured from chemical analyses of the herbage from top-dressed and un-top-dressed soils, and in the case of definite malnutrition areas the determination of some mineral shortage may lead to corrective methods along the lines of top-dressing the pastures with suitable fertilizers.

National Arboretum.—This year's annual report of the State Forest Service states that the original area of 50 acres acquired for the establishment of the national arboretum at Rotorua has been extended by the acquisition of 20 acres of adjoining land. Stocks of about two hundred and fifty indigenous and exotic species are being raised in the Whakarewarewa Nursery for the arboretum, and the first instalment of specimens will be planted therein during the 1928 planting season. Every effort is being made to make the arboretum fully representative of the world's principal softwood utility and ornamental trees.

ANIMAL HUSBANDRY.

J. McLINDEN, M.R.C.V.S., N.D.A., Officer in Charge, Animal Husbandry Branch,
Live-stock Division.

LITTLE introduction is required to the subject of animal husbandry. On the institution of the Animal Husbandry Branch as a distinct unit of the Live-stock Division, however, an indication of the ground to be covered may no doubt be desirable. For a number of years past the general trend of all things pertaining to agriculture has been towards specialization. The institution of the new branch means that certain officers will be freed from all other duties so that they may devote their full time to the advising of farmers seeking information on the breeding, feeding, and general management of their stock.

Animal husbandry, concisely though somewhat crudely explained, means the study of the breeding, feeding, managing, and marketing of farm stock for their respective purposes as economically as possible, yet with due regard to all other branches of farming, so that the latter may in no way suffer, but be utilized to their fullest capacity. It is quite a simple matter to achieve wonderful results in some particular branch of husbandry at the expense of another, but it is not quite so simple a matter to achieve equal results economically. If there is no economy effected—a real economy, of course—by the system adopted, then the results must be false and misleading.

BREEDING.

Volumes could be written on the subject of breeding—and all to little purpose. This is a subject, so far as high-grade pedigree stock and the more subtle refinements of type are concerned, which cannot be dealt with satisfactorily on paper, because it is an art. Provided, however, the discussion is confined to ordinary commercial stock, much interesting and valuable information of a practical nature can be given from time to time. What can be done is to keep before the farmer the type of stock required, the interpretation of milk records, the building-up of the dairy herds from inferior stock, and suchlike.

Then, there is the breeding and fattening of pigs. A cursory examination of commercial stocks is enough to show that great losses must be suffered annually through want of uniformity of type, size, and age. This Branch will act as a source of information on these matters, especially for those who have not yet attempted the fattening of pigs for pork or bacon, in which many no doubt have refrained from participating through lack of confidence. Dependence on the next-door neighbour for information may not always be a bad method, but the information often quite inadvertently proves to be wrong. This is especially true where the trouble happens to be malnutrition, or in some instances even overfeeding. It is not only necessary to know what type of commercial stock to breed, or in some cases to procure, but also to be in a position to know how to feed the stock profitably once they are established.

FEEDING.

In New Zealand the matter of feeding presents many peculiarities. The country is to a great extent isolated and away from the great

trade routes, with the result that supplementary feeding is chiefly dependent on home-grown supplies. The economic use of such foods as linseed cake, cotton-seed cake, &c., for ordinary commercial herds at the present time, unless in exceptional cases or for special purposes, is hardly feasible. So, with a general routine method of feeding, concentrates may be passed over. A very large proportion of the farmers of the North Island could be described as graziers pure and simple. It is easily understood how it is questioned whether even a small amount of cropping is profitable on high-priced land. By actually costing the crop, more than probably it would not be found profitable. But the value of the crop as a diet to the stock in times when grass is scarce must be reckoned. The cost of a crop produced in no way represents its feeding-value, and the feeding-value in turn in no way represents its value as a food when the natural food is not able to sustain the stock, such as in winter and early spring.

Health of stock means a great deal. If stock are not kept continually in a thriving condition, then there is no saying how far-reaching the losses are going to be. Once a dairy cow, for example, is allowed to fall off in her production she will never be brought back to her full yield again in that season. That is why the spring is so critical a period. No doubt such cows will improve as the season advances, but never to the level that should have been attained. Climatic conditions are frequently blamed for the lack of cropping in certain areas. The conditions certainly may not always be of the best, but more could be done in the way of producing supplementary food. A good example has been set by many farmers, and it is to be hoped that the majority will follow suit.

As breeding advances in regard to production, so must the feeding. A cow in her normal or wild state will furnish enough milk to feed one or two calves. Compare that animal with the good dairy stock of the present day, the result of intensive breeding by the use of good sires and judicious culling. On an average, they are producing very much more than just sufficient to feed a couple of calves. The present-day cow is expected to give, say, 300 lb. or 400 lb. of butterfat on the very same diet. The defect may not show up at once, but it will in later generations. The production of the cow has been bred up, but has the bowel-capacity been increased? It certainly has not been increased in proportion to production. It must be remembered that as production increases, the quantity and quality of food required increases at a greater rate, thus following the law of diminishing returns. This means that as it is impracticable to breed up an animal possessing enormous digestive capacity it is essential that food of high feeding-value and less bulk, such as farm grains, silage, and hay, be substituted, especially in times of grass shortage.

Of course, great differences occur in the feeding-value of the same crop grown in different localities and even under different systems of farming. A well-mixed pasture will have a far greater feeding-value than one containing practically only one type of grass. This in turn is superior to one which is well mixed with weeds. Even with apparently good well-laid-down pastures the system of manuring and management will greatly influence feeding-value.

MANAGEMENT.

The system of management adopted throughout the country with many dairy herds is doubtless a survival of the days when the chief industry was the fattening of stock. Although fattening stock may profitably be kept continuously outside without cover or shelter, it does not follow that the same method can be successfully carried out with dairy stock. They require much greater protection. At any rate, there are very few farms which would not be benefited by a more liberal provision of shelter-belts, and the use of good warm covers on the stock should also be made more general. Treat a dairy cow well and she will do her best; treat her badly and she will return accordingly. It is difficult to understand why some men will make every endeavour to increase production by judicious breeding and yet overlook the necessity of good shelter and the use of covers during the rough, cold season. Comfort must be attended to as the production value of a herd improves. There is no doubt about stock being under much healthier conditions when kept outside, but it is essential that the animals be given proper protection and made comfortable.

The two factors, health and production, are valuable assets when found together. Production with lack of constitution, or one undermined through lack of sufficient nutrition at all times, will assuredly end in failure. It is when increased production is being achieved that any faults or flaws in management become apparent. With the exercise of care and with selection the production value of a dairy herd, for example, can be materially increased by using good-quality bulls; but at what cost if due care has not been observed in diet, breeding, culling, and management? Many a good herd has been ruined by owners taking too narrow a view and failing to keep all other necessary factors in line with the advance in production. If output only is kept in mind, and necessary care in breeding and feeding neglected or overlooked, the health of the stock is bound to suffer.

The production problem for those engaged in the fattening of pigs is really how they are going to defeat time and prevent time from defeating them. It is to be hoped, with better methods being adopted, that this industry, instead of turning its capital over once every twelve months, will be in a position to turn it over twice in the same period. It is the interest on the turnover of capital that is required for successful farming. Once a year is too slow.

Under present economic conditions the farmer is being compelled to demand from his stock the greatest possible returns for the capital and labour outlay. If a cow, for example, can be bred which will give 400 lb. of butterfat per annum on practically the same feed as another which will give only 250 lb., it is the former cow which the farmer at the present day finds he must keep. It is to be regretted that far too many cows have found their way into the milking-shed, and remain there, which should have been culled at least after the completion of their first season. True, all farmers are quite well aware of the fact that it does not pay to keep a poor producer, but obviously they do not all fully realize the importance of carrying their convictions into effect. It would be wrong to say that the presence of so many uneconomic producers in herds at the present day was due to sheer carelessness, nor would any farmer knowingly retain such a class of

stock if he could do otherwise. But too often the poor unprofitable stock are removed—only to be bought and taken into other herds.

Frequently it does happen that a farmer is compelled to buy in cows at calving, but to make this a rule—to depend on a supply of fresh material for the herd from the local stock-sale—is indeed the poorest of poor practice. Yet that is actually what is commonly happening. No one will deny that many high producers have been procured in this way, but their proportion to the low producers is very small. It would be a precarious undertaking to attempt stocking a high-producing herd by such a method. It always should be remembered that such bought-in cows frequently represent what some one else has discarded as useless.

The most prevalent practice, of course, is the buying of heifers at calving. Here it may be held that discards are not being bought—that it is surplus stock from the raisers. That is frequently the case; the animals have been reared specially for sale as calving heifers. This is a system carried on in all dairying countries by those who find that they are as well in pocket by raising young stock for sale as by carrying a dairy herd of their own capable of utilizing all the pasture which they possess. Stock-raisers who follow this practice do not care what sort of heifers or cows they are selling. They may, very likely, have bought the cows dry and put them on some rough pasture to eat it down. Their main object in keeping the animals was to help to turn to some advantage to themselves a piece of rough pasture which otherwise would be unprofitable. Such animals do not constitute surplus dairy stock in the true sense. They are procured and then bred to any bull—it matters not of what quality so long as he puts them in calf. Some of their progeny, again, may meet the same routine, and so the practice goes on. No progress can be made under such a system. There is no use in a farmer culling his stock if he is going to bring into his herd stuff like this. It would be much more profitable for him to do a little breeding and stock-raising himself (using good bulls, of course) than to persist in depending on the auction sale.

To raise stock on good land certainly does make them more expensive as heifers at calving, but then their cost does not represent their market value alone to the breeder. There is the added valuable knowledge of their ancestors, and their constitution and production; also the knowledge of their treatment and management as growing stock as well as their probable capabilities. The farmer has the opportunity to give them the necessary care and management that will enable them to produce and possess the constitution to do so. He can give them the start in life which is so essential, but is so frequently overlooked or even ignored. The rearing of any heifer calf or bull calf in an indifferent way will never be conducive to profitable returns. It is essential to be painstaking. As a rule dairy-farmers must select their own young stock and rear them, for improvements are never made easily.

Doubtless many a cow at present only giving a moderate yield could be greatly improved by different methods of handling, but that aspect cannot be dealt with in the present introductory article. As time and opportunity permit the various aspects of breeding, feeding, and management will be discussed in detail.

WHEAT - VARIETY TRIAL AT ASHBURTON EXPERIMENTAL FARM, SEASON 1926-27.

A. W. HUDSON, B.Ag., B.Sc., Instructor in Agriculture, Christchurch.

IN 1926-27 the trial of a number of varieties of wheat was made at Ashburton Experimental Farm for the third season in succession. One or two varieties previously under trial were eliminated on account of certain undesirable characters, such as weakness of straw and lack of uniformity of type.

ARRANGEMENT OF PLOTS.

A very limited area of ground was available, and the plots were arranged so as to give the maximum number of replications possible.

College Hunter's seed from the previous trials was again used as a standard with which the other varieties were compared. Six replications of the varieties were sown, every third plot throughout being sown with College Hunter's. This arrangement brought the standard variety immediately alongside each plot of the other varieties. Designating the College Hunter's by "C.H." and the other varieties as "V. 1," "V. 2," &c., the following example, using three varieties, illustrates the lay-out:—

V. 1—C.H.—V. 2—V. 3—C.H.—V. 1 V. 2—C.H.—V. 3—V. 1—C.H., &c.

In all, 118 plots were sown in this way. Each plot was one width of a seven-coulter drill, and separated from its neighbours by 14 in. spaces (see Fig. 1). The method of sowing was as described in the *Journal* for July, 1926, p. 6, under heading of "Cereal Manuring Experiments."

SEEDING.

Again seeding was done so as to give as nearly as possible the same number of seeds per acre for each variety. This was done as in previous years by weighing a large number of 100-grain samples, calculating their mean weights, and then estimating the weight of each variety required to give the same number of seeds as $1\frac{1}{2}$ bushels of College Hunter's. An amount as near as practicable to the quantity thus calculated was sown.

METHOD OF HARVESTING.

Each plot was divided into four subplots each $36\frac{1}{2}$ yards in length. All but five varieties ripened before the standard variety (see table), and had to be cut with reaphooks. The remainder were cut with the reaper-and-binder.

Reasonable care was taken to keep varieties pure, although a little mixing is of no consequence, as, in addition to the comparative yield trial, several of the varieties were grown in "increase" plots which were carefully rogued and every care taken to keep them pure during and after harvesting.

The yields, &c., are shown in the table on page 316.

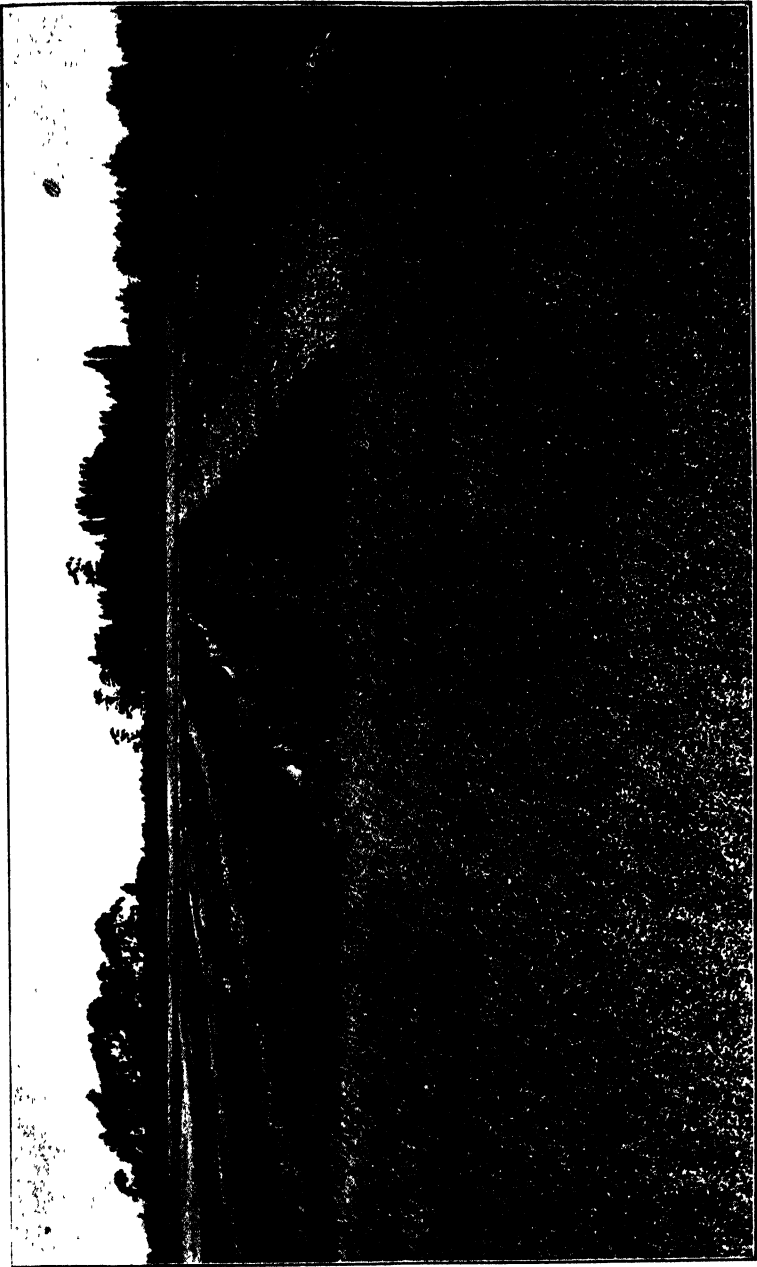


FIG. 1 PORTION OF THE WHEAT VARIETY PLOTS AT HARVEST-TIME IN JANUARY, 1927 (OAT CROP IN FOREGROUND.)
The College Hunter's plots are marked by crosses Some of the early-ripening varieties, cut by hand, are seen in stook.
[Photo by the Writer.]

Yield of Wheat Varieties at Ashburton Experimental Farm, 1926-27 Season.

Variety.	Number of Paired Plots.	Yield per Acre.		Difference in Favour of Variety (+) or College Hunter's (-) in Preceding Seasons.	Date of Opening of Variety in January, 1927 †	Difference in Favour of Variety (+) or College Hunter's (-) in Preceding Seasons.	
		Variety.	College Hunter's.			1924-25.	1925-26.
Major	Bushels. 47.9	Bushels. +8.6	..	Bushels. +5.5	Bushels. -4.9
Solid-straw Tuscan	39.3	+7.1	..	No plot	N.S.
Queen Fair	45.9	+4.7	S.	+4.5	-6.9
White-straw Tuscan	44.4	+3.6	S.	+9.0	-2.3
(X) Velvet x Solid-straw Tuscan ‡	42.9	+3.3	S.	No plot	No plot.
Marquis	39.7	+2.8	S.	+2.9	-3.2
Goldberry	41.5	+2.4	S.	No plot	N.S.
College Velvet	39.7	+1.0	S.	No plot	N.S.
Trifolium 14	40.7	+0.5	N.S.	No plot	No plot.
Red Fife	37.8	+0.4	N.S.	+5.7	-1.7
Essex Conqueror	38.8	-0.8	N.S.	-5.0	N.S.
Yeoman II§	38.1	-5.1	S.	No plot	No plot.
College Hunter's (direct from College)	33.0	-0.4	N.S.	Standard variety	Standard variety.
	from	from	39.5				

* A difference is regarded as significant only when the chances are 30 to 1 or greater in its favour.

† The standard variety (College Hunter's) ripened on 31st January.

‡ This variety, which appears to be a cross between Velvet Grief and Solid-straw Tuscan, was found as an impurity in another variety by Mr. F. E. Ward (now Director of Agriculture, Tasmania).

§ Yeoman II was grown from seed imported direct from England and came to the Department of Agriculture through the courtesy of Dr. Hilgendorf; the germination was poor, no doubt accounting for low yield.

|| See under subheading "Origin of Seed Trial" (page 318)

COMMENTS ON THE TABULATED RESULTS.

In the 1926-27 season seven varieties have proved superior in yield to College Hunter's to a significant extent; five varieties equal College Hunter's, or at least do not differ from it significantly; and one (Yeoman II) has proved decidedly inferior. The Yeoman II replaced Yeoman I of the trials of previous seasons, and suffered a severe handicap on account of very poor germination in its first season in New Zealand. Hence its poor yield must not be regarded as representative.

The season 1925-26 was an unusual one in that the winter was extremely wet. The whole crop, being in a paddock which poached very badly, was extremely poor, the yields ranging from 7.7 to 15.2 bushels per acre on different plots. Certainly the College Hunter's showed its ability to withstand extremely bad conditions better than most of the other varieties.

Four of the varieties shown in the table showed no significant difference from the standard, while all the remainder were decidedly inferior. The varieties Major, Queen Fair, White-straw Tuscan, and Marquis, which in 1924-25 and 1926-27 yielded so much better than College Hunter's, did very poorly in the 1925-26 season.

The 1924-25 season's results showed a marked resemblance to those of 1926-27. The two varieties which have been most erratic in behaviour are Red Fife and Essex Conqueror. The former out-yielded Hunter's in the 1924-25 season by 5.7 bushels, but does not differ from it in the 1926-27 season. The latter has advanced from a yield of 5 bushels less than Hunter's in 1924-25 to one practically equal to it in 1926-27.

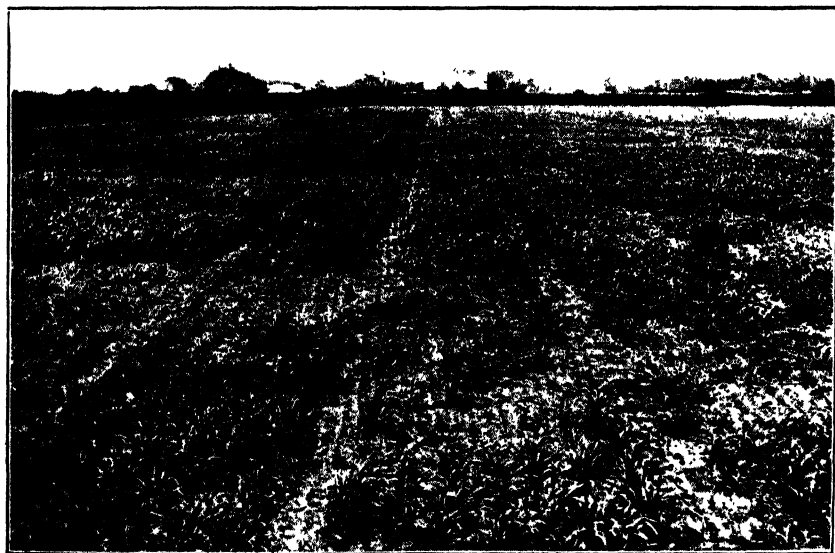


FIG. 2. PORTION OF THE WHEAT VARIETY PLOTS IN EARLY STAGE BADLY ATTACKED BY GRASS-GRUB

Plots so affected were not taken into account in calculating yields. Photo taken on 13th October, 1926.

[Photo by the Writer.

Origin of Seed Trial.

The question was raised as to whether seed from a crop yielding about 15 bushels per acre would be as satisfactory as that from a 40-bushel crop. Dr. F. W. Hilgendorf, of Lincoln College, was of opinion that both samples would prove equally satisfactory, and a double trial was decided upon. A sample of the line of College Hunter's used as the standard in the Ashburton variety trial which had been two seasons removed from Lincoln College and yielded 15 bushels per acre in the 1925-26 season was tried at Lincoln College against College Hunter's which had yielded 40 bushels per acre at Lincoln in the 1925-26 season. Correspondingly, a sample of the latter was transferred to Ashburton and included in the variety trial. As will be seen in the table, there was no significant difference in yield between the two.

Dr. Hilgendorf reports on the College trial as follows: "Comparison was made between twenty-three paired plots. Mean of College seed plots, 33.6 bushels per acre; mean of College Ashburton seed plots, 34.7 bushels; difference, 1.1 bushels. Odds in favour, 16 to 1 (non-significant). The total superiority of all the Ashburton seed plots over all the College seed plots was 27 bushels. In one pair of plots the difference in favour of the Ashburton seed was 13 bushels per acre. This single plot accounted for almost half the increase, and suggested an error in threshing or weighing, or a gross irregularity of soil. If this single plot was left out half the superiority of the Ashburton seed would disappear, and in any case it is non-significant."

The excellent work of Mr. J. G. McKay in the drilling of the plots is evident in the photographs. His valued assistance, and that of others mentioned in a previous article, was largely responsible for the success of the work as a whole.

BLISTER DISEASE OF APPLES.

AN investigation was made by the Biological Laboratory into the causes of an obscure disease that made its appearance last season in certain parts of the Motueka fruitgrowing district—the blister disease of apples. The annual report on the work of the Laboratory states that although the lesions which occurred in the fruits showed the presence of a fungus *Coniothecium* this parasite was found to be of merely secondary importance. Certain physiological irregularities had been brought about by unfavourable soil conditions, weather conditions, and orchard-management. After closely examining the circumstances in which affected trees were to be found, the conclusions reached were that the rooting-systems were feeble through shallow rooting due to an impenetrable pan, through root-injury in cultivation, and through lack of drainage. The remedy recommended was to raise the vigour of the trees by various means, such as drainage, manuring, thinning, hard pruning, &c., according to the circumstances involved. Another non-parasitic disease—brown-core of apples—which showed itself in the form of brownish masses variously distributed in the pith and cortex of apple fruit, was ascribed to similar causes, and was probably precipitated by the unusual weather conditions that preceded its appearance. There is little doubt also that the dying-back of Delicious and Sturmers that was unusually prevalent in this season was due to similar causes. There is no doubt that this investigation uncovered a group of conditions that have been insidiously operating against the orchardists on a very considerable area of country.

OPEN FERN - LANDS OF THE KING-COUNTRY.

NOTES ON THE ARIA CO-OPERATIVE TRIAL BLOCK, 1926-27.

J. E. F. JENKS, N.D.A., Instructor in Agriculture, Te Kuiti.

FIELD trials in connection with grassland must necessarily be of a more prolonged nature than those with annual crops, and the attainment of reliable results is a matter of several years' work. The trials at Aria, though they have included some useful work with fodder crops, are located in a district where every farmer is primarily a grassland farmer. Consequently the value of these trials lies in the accumulated observations of several years' work in the formation and treatment of pastures rather than in any one season's results. (Previous articles on the work at Aria have been published in the *Journal* for March, 1925, and September, 1926.)

CROPPING.

The past season saw the close of the cropping. The flat (Fields A and B) was ploughed in November last, and sown on 7th December with millet mixtures. Earlier sowing would have been preferable, but was not possible owing to the waterlogged nature of this particular area. Four $\frac{1}{2}$ -acre plots were sown as follows:—

- (a) Japanese millet 16 lb., cow-grass 4 lb., per acre ; cost, 7s. 4d.
- (b) Japanese millet 12 lb., black barley 1 bushel, per acre ; cost, 12s.
- (c) Japanese millet 20 lb. per acre ; cost, 3s. 4d.
- (d) Japanese millet 12 lb., Hickory King maize 1 bushel, per acre ; cost, 12s.

Manure, $2\frac{1}{2}$ cwt. 44/46 super per acre.

Grazing was commenced on 14th January, and continued at intervals throughout January, February, and early March. The crop maintained the flow of milk and probably left a profit. An acre of millet costs for seed, manure, and labour about £2 10s., and will provide succulent supplementary feed for at least five cows for two months at a time when it is important to arrest the natural tendency for the flow of milk to decrease. An extra 8 lb. of butterfat per cow (1 lb. per week) covers the cost of the crop. It is always advisable to sow in two portions and graze alternately. Of the four plots, (a) and (c) were the best as well as the cheapest, (a) is a useful mixture when the land is not required for cropping until the following spring, as it checks weeds and provides some good autumn feed. The black barley made a poor showing ; the millet is too strong a competitor during the warmer weather. The maize was well eaten, but was very thin owing to the seed being imperfectly covered.

Field L, where the lucerne failed, was ploughed and worked for swedes in December. Unfortunately, drilling was delayed till 14th January, and the fly played havoc with the young plants. Experience this season in the King-country was that early drilling (10th to 20th December) gave the best results. A number of plots were sown : Superlative, Bell's Mervue, Best of All, Bell's Improved Bronze-top,

Crimson King, Prima Donna, Sharpe's A1, Sharpe's Ne Plus Ultra, Danish Giant, Bangholm, and Studsgaard. Manure was 1 cwt. basic super and 1 cwt. bonedust per acre (the lucerne had been top-dressed in September).

On the whole no variety showed definite superiority over the Superlative; the crop was not good enough for weights to have any significance, though some good individual roots were grown. Bangholm, a white-fleshed Danish swede with a top resembling a soft turnip, grew fast and showed great promise, but started to decay early in July; for early use this variety may prove useful. Chou moellier was a good crop, but thousand-headed kale gave as much feed and seemed to be preferred by the cows. A mixture of Italian rye-grass and subterranean clover showed good promise as a catch-crop for early spring use. The hay and roots were fed out on Field J, which should help that paddock considerably.

NEW GRASS.

After the millet in Fields A and B (the flat) was finished, the land was ploughed, worked, and sown to permanent grass with 3 cwt. 44/46 super and 1 cwt. blood-and-bone per acre. There are eight $\frac{1}{4}$ -acre plots, as follows:—

Pasture Species.	Plots 1, 4, and 7.	Plot 2.	Plot 3.	Plot 5.	Plot 6.	Plot 8.
	lb.	lb.	lb.	lb.	lb.	lb.
Italian rye-grass ..	4	4	4	4	8	10
Perennial rye-grass ..	12	12	8	15	12	12
Cocksfoot (Akaroa) ..	8	..	14	..	..	..
Crested dogstail ..	1	1	3	1	1	..
Timothy ..	2	2	1	3	2	4
Meadow-foxtail ..	2	2	..	4	1 $\frac{1}{2}$	..
Meadow-fescue ..	..	10	..	..	..	..
Poa trivialis ..	$\frac{1}{2}$	$\frac{1}{2}$	..	1	$\frac{1}{2}$	..
Paspalum (Australian) ..	..	..	..	..	5	..
Cow-grass ..	3	..	3	3	3	3
Alsike ..	..	3	..	..	..	..
White clover ..	1	1	1	1	1	1
Subterranean clover ..	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	1	1
Prairie-grass ..	..	..	..	..	..	1*
Total seeding per acre ..	34	36	34 $\frac{1}{2}$	32 $\frac{1}{2}$	35	31 $\frac{1}{2}$

* Bushel.

† Excluding prairie-grass.

Each plot cost approximately £1 14s. per acre for seed.[†] This area was sown late in March. The young grass started well, but the continuous wet during the past winter inflicted serious damage in the lower-lying places.

Field L was sown this spring with a paspalum-rye-clover mixture.

PASTURE NOTES.

The plots in Field M continue to be remarkably even as far as appearance is concerned. Even the "cheap" mixture on Plot 1 (rye-cocksfoot-clover) is making a good turf. The danthonia on Plot 3 is just visible in places, but is overshadowed by the stronger-growing species. Plot 4 (no cocksfoot) is always closely grazed and shows

distinct promise ; it may well be that under regular top-dressing and rotational grazing a permanent sward of rye, timothy, and dogstail can be maintained even on this light country. This field was top-dressed in August, 1926, with 3 cwt. 44/46 super, and cut for hay in January, 1927. At other times it has been grazed at intervals by dairy cows.

The plots in Field F are doing well. Paspalum is gradually taking charge of Plot 1, where Chewings fescue has done only moderately and red-top is hardly to be found. Brown-top and dogstail are doing well on Plot 3. The kikuyu on Plot 2 made good progress last summer, but its long dormant season (May-October) is against it here. Imported wild white clover has done fairly well.

FERTILIZERS.

Potash was tried last season in conjunction with the regular top-dressing of super. Plots of 30-per-cent. potash were sown in Fields J and M at the rate of $\frac{1}{2}$ cwt. per acre, and kainit in the same paddocks at the rate of 1 cwt. per acre. In Fields E and F, where there is always a certain amount of bracken-fern, strips of kainit were sown at the rate of 2 cwt. per acre. At no time was there any visible benefit, nor did stock show the slightest preference for the potash plots.

In this locality super apparently gives no better results on limed plots than on unlimed. It is reasonable to suppose that basic super or lime and super should be better manures than super straight, but there is no evidence in support of this theory. One can only conclude that readily available phosphates are the outstanding requirement and are the only class of fertilizer profitable to use, at least as far as top-dressing is concerned.

REGRASSING METHODS COMPARED.

Prior to 1921 the whole area (except the flat) had received the same treatment, having been sown to grass in 1905 after turnips and never top-dressed. In 1920-21 Fields L, M, and F were ploughed, turnipped, and sown to temporary pasture. In 1923 cropping was recommenced in these paddocks, and the reclamation of the old pasture in Fields J and E was commenced. This old pasture at that time consisted (on visual inspection) of fog and cocksfoot, with some *Poa pratensis*, *danthonia*, and suckling-clover, together with scattered bracken-fern and Strathmore weed. It was typical of thousands of acres of semi-deteriorated open-country pastures in South Auckland.

Fields J and M afford the first comparison. Both are more or less undulating. At the outset Field J was in rather better condition than Field M ; it has a slightly better soil, and had been used by stock as a camp. Manures are calculated at to-day's prices plus freight and cartage.

Field J ($2\frac{3}{4}$ acres) :—Costs from 1923 : October, 1923, super, slag, and lime, £3 2s. 6d. ; July, 1924, slag, £2 12s. ; May, 1926, seed for patch-sowing, £1 ; August, 1926, super, 30-per-cent. potash, and kainit, £2 13s. 6d. ; harrowing, sowing manure, mowing, and raking fern, £4 : total, £13 8s., or £4 17s. 6d. per acre.

Field M : It is allowed that the value of the crops grown—turnips, millet, and oats—paid for the seed, manure, and labour expended

on them—a conservative estimate. Costs since 1923 are as follows: Autumn, 1925, ploughing, working, and sowing, £4; seed and manure, £6 7s.; August, 1926, super, 30-per-cent. potash, and kainit, £2 8s.; harrowing and sowing manure, £1: total, 13 15s., or £6 17s. 6d. per acre.

Thus Field M has cost £2 per acre, or approximately 40 per cent., more than Field J, but there is no question as to their relative quality. The pasture in J has certainly shown great improvement, but response has been slow, and the turf is still far from being first-rate. It is barely up to dairying standard; the cows are not fond of it. Field M would be considered good even in the best parts of the Waikato. It cut over 2½ tons of hay per acre, and the cows will break fences to get into it. Admittedly, it is still young, but the bottom is steadily improving; every ounce of manure now applied to it will benefit good grasses and clovers, while half the manure applied to J is still going on to weeds, bare ground, and low-grade plants such as fog and suckling-clover. Bracken-fern is still troublesome in J; it has disappeared in M. The pasture in M is worth at least twice as much to the farmer as that in J; it has certainly not cost twice as much to obtain. Unquestionably, it has paid to plough in this case.

Fields E and F are a parallel case. Field F was sown down after cropping in September, 1924; spring sowing let the fern away, and though it is now well in hand autumn sowing would have been preferable. Costs since 1924:—

Field E (1½ acres): July, 1924, slag and basic super, £1; May, 1926, basic super and kainit, £1 13s.; May, 1926, seed for resowing, £1; cutting fern and sowing manure, £1 10s.: total, £5 3s., or approximately £3 9s. per acre.

Field F (1 acre): Spring, 1924, ploughing, working, and sowing, £2; spring, 1924, seed and manure, £3; August, 1926, super and kainit, £1 5s.; harrowing and sowing manure, 10s.: total, £6 15s.

Both paddocks are rather steep and only just ploughable; in fact, one would hesitate to plough. However, the top-dressing of old run-out grass in Field E has been disappointing; even surface-sowing in conjunction with the manure has not been wholly satisfactory. Certainly the pasture has improved, but the original grass was too far gone to respond, except, of course, in those places where the fern had been kept in check. On the other hand, the cropping and ploughing checked the fern in Field F, and an opportunity was afforded for the establishment of a good sole of turf-forming species such as *paspalum*, brown-top, and *Lotus major*. Field F responds well to fertilizer and is closely grazed by the stock; it is worth fully twice as much per acre as Field E, where the grass still occupies less than half of the ground and a constant war must be waged against weeds and fern. This does not mean to say that all pastures must be ploughed before they can be regenerated, but it is evidence that where pastures on ploughable land have seriously deteriorated it is sound policy to plough and regrass first.

Ophthalmia (Temporary Blindness) in Sheep.—This complaint was reported as rather common in the Wairarapa, Stratford, and Marlborough districts during the past year. Investigations in progress at the Wallaceville Veterinary Laboratory suggest that the disease is contagious.

FARMERS' FIELD-CROP COMPETITIONS.

AUCKLAND PROVINCE, SEASON 1926-27.

J. W. Woodcock, N.D.A., Assistant Instructor in Agriculture, Auckland.

FARMERS' field-crop competitions were continued during the 1926-27 season at Otorohanga, Whangarei, and Mauku, and new competitions were established at Elstow (Te Aroha), Te Kowhai, and Cambridge. Although the excessively wet weather last spring was detrimental to good cultivation in the early stages of growth, the subsequent results obtained were highly satisfactory. Altogether sixty-two crops were judged, of which thirty-eight were mangolds, five carrots, eleven swedes, six soft turnips, and two chou moellier.

The judging was carried out at Mauku by Mr. T. H. Patterson, Instructor in Agriculture, and at the other centres by Messrs. Hamblyn, Jenks, Wild, and the writer, all of the Fields Division. In most cases farmers turned out in fairly large numbers to see the crops judged. A display of cups, trophies, and roots from winning crops was staged at the Waikato Winter Show, the exhibits being described by cards giving full particulars of origin and cultural methods.

At the various centres which have been holding competitions for the past two or three years the average yield of roots is steadily increasing and the standard of cultivation has improved. Moreover, farmers, by accompanying the judges, themselves gain useful knowledge by observing other crops and the conditions under which they were grown.

MANGOLDS.

The mangold crop is the most popular one from the competitive point of view, because it is one that responds to care and cultivation; and since a comparatively small area is grown on the farm it is a crop in which the farmer generally takes special pride.

The following particulars, giving the yield per acre at three centres, show how the average of the first three winning crops at each centre has been increased:—

				1924-25.	1925-26.	1926-27.
Mauku	..	..	..	.. 53 tons	60.5 tons	61.5 tons.
Otorohanga	..	..	..	.. ..	66 ..	66.6 ..
Whangarei	..	..	..	.. ..	42 ..	57 ..

The various competitions in 1926-27 were won as follows:—

Mauku: R. K. Membery, Patumahoe; Prizewinner Yellow Globe variety, 71½ tons per acre.

Otorohanga: H. A. Lurman, Otorohanga; Prizewinner, 81 tons per acre.

Whangarei: J. Breslin, Titoki; Long Red, 64 tons per acre. This is Mr. Breslin's second win in succession, and he gained both first and second places in this year's competition.

Te Kowhai: A. G. Porter, Te Kowhai; Jersey Queen and Yellow Globe, 59.6 tons per acre.

Varieties.—The Prizewinner variety is rapidly displacing the once popular Long Red, especially on the volcanic soils and light loams, although Jersey Queen has a wide popularity, especially in Waikato.

White Sugar is growing in favour. This variety has a higher sugar and dry-matter content than any other variety, besides being a heavy cropper, and it is probable that if points were given for feeding-value as indicated by the sugar content the White Sugar mangold would hold its own in popularity with any other. The Long Reds grown in the competitions were inclined to become hollow after the bulbs had attained a fair size.

Manuring.—One of the most outstanding features of the competitions was the response to organic manures. At Otorohanga the winning crop was given 4 cwt. of fish-manure in addition to cowyard manure; the second crop had liquid pig-manure, while the third was grown on a heavily dunged soil. At Mauku the winning crop received 5 cwt. of 30-per-cent. potash salts only, but it must be realized that this followed an early potato crop which was manured with about a ton of a mixture half of which was bonedust. Moreover, it had previously had a good deal of dung. The need for organic manures for the mangold crop on the lighter soils is apparent, and this fact has often been demonstrated in the past, especially where the crop is not taken after grass. Some of the best crops were top-dressed with nitrate of soda, which is good practice if done early enough. Most of the competitors realized the need for salt and potash.

Spacing.—This was the greatest limiting factor. Some well-cultivated crops lost tonnage in this way, while other crops not so well cultivated gave heavy yields. The rows should be just wide enough to allow the crop to be intercultivated with fair ease, and 24 in. to 26 in. apart is quite a suitable distance, varying, of course, with the variety grown.

Previous Cultivation.—This is a most important factor on volcanic soils with a poor moisture-holding capacity and a low humus content. The first ploughing, especially if the crop is taken after grass, should be early, in order to allow the vegetable matter to become well incorporated with the soil. The winning crops were all well cultivated both before and after the seed was sown, and the first ploughing was done in June and July.

Amount of Seed and Time of Sowing.—These factors varied considerably, but it would appear that a fairly heavy seeding—from 6 lb. to 8 lb. per acre—gives the best crops. The practice of sowing the seed in special beds and transplanting the young plants is becoming a popular one in Auckland Province. The labour required for this method is probably not much more than is needed for singling, since in most cases the plants are put in with the aid of the plough. The ground can be given much extra cultivation before the planting-out is done, just at the time when annual weeds are most vulnerable. Further, where grass-grubs and caterpillars are bad this method is again of advantage in that the larger plants are not generally attacked. Most of the crops not grown in this manner were grown on the ridge, but it is doubtful whether ridging the land pays if the land is fairly clean, unless it is done on heavy land with plenty of moisture. The date of sowing varies according to the district: late October is suitable for the North, but the middle of November appears quite early enough for South Auckland.

After-cultivation.—This is one of the most important factors in the production of a heavy crop, yet it is one that is too often overlooked, and the particulars of cultivation after the crop was sown are often omitted from the entry form as if it were a fact too trivial to mention. Yet all the winning crops were well cultivated, most having been horse-hoed five or six times. In order to produce 80 tons of a crop containing at least 60 tons (probably more) of water, it is essential to conserve as much soil-moisture as possible, and this can be done only by keeping the surface well cultivated during growth of the crop.

In all competitions the initial entries were large, but during the course of the season many withdrawals were made for various reasons. It must be impressed on farmers that the chief aim of the competitions is to get at the reasons for the failures, as well as the methods employed by the successful growers, and it is the knowledge to be gained as much as the prize to be won that should produce the greatest effort.

CARROTS.

The carrot crops judged showed a marked improvement on those of the previous year. Two competitions were held, one at Whangarei and the other at Otorohanga, but at the latter centre only one entry was received. This was an excellent crop of White Belgians, yielding 41 tons per acre, grown by E. Langkilde, Otorohanga. The Whangarei competition was won by H. Crane, Ngaratunua, with a crop of 42 tons per acre of White Belgians, a variety which predominated in the competition. From 2 lb. to 3 lb. of seed per acre, sown in 14 in. drills, gave the best results, but under these conditions the hand-hoe only can be resorted to. The chief fault noticed with the crops in this competition was the neglect of proper thinning in the rows.

SWEDES.

Two competitions were held, one at Otorohanga and the other at Elstow. The former was won by Mr. J. Sing, Otorohanga, with 60½ tons per acre, while Mr. W. T. Dale, Waihou, carried off the honours at Elstow with a crop of 43·4 tons.

Superlative was the variety most used, and it proved to be an excellent one for both districts. Basic super or super and lime appear to be quiet adequate for manuring, but there is a tendency to use too little. On the lighter soils a proportion of bonedust, up to one-third or one-half of the mixture, might be added with advantage. Most crops were grown in 12 in. or 14 in. rows without after-cultivation; it has been found that ridging or the use of wide rows reduces the yield per acre, and intercultivation does not appear to be payable. The rate of seeding was invariably 12 oz. per acre.

SOFT TURNIPS AND CHOU MOELLIER.

One competition for soft turnips was held at Elstow, the winner being Mr. A. Davey, Te Aroha, with 28½ tons per acre of the Green Globe variety.

The only competition for chou moellier was won by Mr. J. Fortune, Otorohanga, with a yield of 27 tons per acre.

GENERAL.

In all the competitions the interest taken by farmers and the results obtained were excellent, considering that many of the competitors are breaking in new country. Substantial prizes were donated by a number of interested individuals and firms. The judges desire to record their gratitude to the various committees for the arrangements made in connection with the judging of the crops. At most centres the practice of having a gathering of farmers in the evening when presenting the prizes is popular, and the social side receives due consideration.

BOYS' AND GIRLS' AGRICULTURAL CLUBS.**TARANAKI AND WANGANUI DISTRICTS COMPETITIONS,
SEASON 1926-27.**

J. M. SMITH, Instructor in Agriculture, New Plymouth.

COMPETITIONS similar to those of preceding years were conducted in the North and South Taranaki and Wanganui districts during last season. Root-growing was carried out in all three districts, while calf-rearing competitions were operated in both the Taranaki centres.

CALF-REARING.

The work of this branch was marked by a very substantial increase in the number of entries, and also by a decided improvement in the quality and condition of the calves brought forward for judging. There is little doubt that the work of the past few years is now being reflected in the quality of the animals reared, and the matter of judging becomes more difficult each season. There are two distinct classes—the Jersey-Ayrshire cross and the Friesian-Shorthorn cross, or a light breed and a heavy breed—and in both of these classes there are two distinct competitions—one for condition and one for dairy type. It may appear to some that undue importance is being attached to condition, and that dairy type is being left in the background, but it must be remembered that the competition is primarily one for rearing the calf and not for the selection of calf or dam. While the importance of type is fully recognized, the fact remains that if a competitor can successfully rear a calf showing little or no type it naturally follows that he or she can rear a “typey” calf just as well.

In the season under review the points for chart were reduced to 25, and an additional 25 marks were given for knowledge displayed in connection with the feeding and general management of calves. Although the factor of cost is now eliminated as far as awarding points are concerned, the competitors are still required to state the actual cost of feeding. The average cost per head for the season was £1 8s. for North Taranaki and £1 6s. for South Taranaki. The entries numbered 117 and 283 respectively for these centres.

Judging was carried out during December, and, as usual, the judges gave demonstrations at each of the schools visited, losing no opportunity of driving home essential facts in connection with calf-feeding. In South Taranaki all group winners are brought to a centre for championship judging, and this took place at Eltham.

This is far the best method of finally selecting the champions, and an endeavour is now being made to reinstate the system in North Taranaki, where it was dropped a year or two ago on account of cost.

In North Taranaki the championship for the Jersey-Ayrshire cross was won by Kathleen Looney, of Koru, who also scored the highest number of points for type in this class. For the Friesian-Shorthorn cross Keitha Patterson, of Kaimiro, brought forward the animal which was finally placed champion, and again this calf scored highest for type. In South Taranaki the champion Jersey-Ayrshire was reared by L. Brown, of Douglas, while the champion Friesian-Shorthorn was won by J. Foreman, Tawhiti. The specials for dairy type in this district were won by E. Sheenin (Auroa), E. Jones (Manaia), B. Green (Okaiawa), and L. Gernhoefer (Rawhitiroa) for the Jersey-Ayrshires, and J. Johnston (Hawera), M. Jones (Finnerty Road), L. Brown (Douglas), and H. Hammonds (Opunake) for the Friesian-Shorthorns.

ROOT CROPS.

The season was not a good one for root crops, particularly in Taranaki. A wet spring delayed sowing considerably, many of the plots not being sown until after the first week in December.

The crops and varieties grown in the different districts were as follows: North Taranaki—Mangolds, Prizewinner and Long Red; carrots, Holmes' Improved and Matchless White. South Taranaki—Mangolds, Red Intermediate, carrots, Barriball. Wanganui—Mangolds, Prizewinner; carrots, Matchless White. It will be noticed that two varieties of both mangolds and carrots were tried in North Taranaki. This departure towards experimental work was not so much to actually test the varieties as to endeavour to create further interest by the competitors and their parents, and in this it was successful. The grouping in North Taranaki was also altered in an endeavour to confine the poorer soils to one group, the better soils to the next group, and so on; but, while the new groups are certainly an improvement, anomalies still exist.

The failure of a number of plots to see the season out is still a matter of concern. By far the biggest factor in reducing the number of plots for judging is the intrusion of stock, and we again bring this matter under the notice of the parents. It is very disheartening to the young competitor to put in much work and care on a plot only to have it destroyed a few days before judging. The proportion of crops presented for final judging in the different districts was—South Taranaki, 57.4 per cent.; North Taranaki, 60 per cent.; Wanganui, 68 per cent.

The placings for the championships were as follows, the places named referring to schools in each case:—

<i>North Taranaki</i> —		Tons cwt.	
Mangolds:	1st, R. Thomas, Tataraimaka ..	..	114 11
	2nd, V. Penwarden, Tataraimaka ..	..	107 12
	3rd, D. Graham, Waitara ..	..	113 16
Carrots:	1st, J. Moffit, Warea ..	..	66 13
	2nd, T. Western, Bell Block ..	..	42 0
	3rd, J. Thomason, Egmont Village ..	..	40 0
Best-kept plot: R. Burrows, Vogeltown.			

<i>South Taranaki</i> :—				Tons cwt.
Mangolds :	1st, G. Putt, Otakeho .. ..	..	..	124 11
	2nd, W. Laursen, Okaiawa .. ..	..	..	108 0
	3rd, B. Laursen, Okaiawa .. ..	..	..	105 8
Carrots :	1st, Una Glynn, Ohangai .. ..	..	..	65 14
	2nd, N. Walker, Okaiawa .. ..	..	..	67 6
	3rd, R. Taylor, Ngaere .. ..	..	..	62 3
Best-kept plot : L. Gernhoefer, Rawhitiroa.				
<i>Wanganui</i> :—				
Mangolds :	1st, C. Morrison, Turakina .. ..	..	..	119 17
	2nd, S. L. Harris, Bull's... ..	..	..	123 5
	3rd, A. Blake, Waverley .. ..	..	..	117 12
Carrots :	1st, A. Blake, Waverley .. ..	..	..	69 9
	2nd, G. Hamlyn, Kakaramea .. ..	..	..	70 14
	3rd, L. Stewart, Ngaturi .. ..	..	..	65 8

It will be noticed that in some instances the winner's crop was actually lighter than that of the second placed competitor ; in these cases the competitor with the heaviest crop has lost points probably on chart.

The usual exhibits were again staged at the New Plymouth, Hawera, Wanganui, and Wellington winter shows, and were the object of much favourable comment.

Senior Boys' and Girls' Clubs.

With a view to sustaining and extending the interest in the movement, and as a means of continuing the instruction over that period between the junior clubs and the farmers' competitions, senior clubs were organized last season in South Taranaki. Cropping was the activity taken up ; the area to be grown was fixed at $\frac{1}{4}$ acre, the crops selected being carrots and mangolds. Further, for the purpose of creating additional interest and for instructional reasons it was decided to embody a manurial trial in the competition. For this purpose a standard manure consisting of three parts super, one part bonemeal, and one part Nauru phosphate was supplied ; in addition half the plot was treated with sulphate of potash at the rate of 1 cwt. per acre, and the other half with salt at the rate of 3 cwt. Certain instructions with regard to cultivation, sowing, &c., were supplied, but width of drills was left to the discretion of the competitor. Charts were also supplied on which such information as description of soil, details of cultivation, total cost of cultivation, &c., were to be recorded. The points fixed for judging were as follows : Yield, 2 for every ton ; cultivation, 10 ; quality, 10 ; chart, 15. Twenty-three entries were received, and eighteen of these completed the season's work

The placed competitors were as follows :—

				Tons cwt.
Mangolds :	1st, W. Dakers, Manaia .. ..	..	..	73 7
	2nd, R. Harding, Ohangai .. ..	..	..	76 6
	3rd, L. Symes, Auroa .. ..	..	..	64 8
Carrots :	1st, R. Wallis, Okaiawa .. ..	..	..	61 10
	2nd, R. Corbett, Awatuna .. ..	..	..	57 8
	3rd, B. Taylor, Ngaere .. ..	..	..	48 7

With regard to the manurial trial it is interesting to record that the average yields of the crops where salt and potash were used were as follows : Mangolds—Standard mixture and potash, 45 tons 3 cwt. ; standard mixture and salt, 51 tons 8 cwt. Carrots—Standard mixture and potash, 42 tons 15 cwt. ; standard mixture alone, 38 tons 14 cwt.

WAIMAUNGA EXPERIMENTAL FARM, 1926-27.

C. S. DALGLIESH, Fields Instructor, Greymouth.

THE season of 1926-27 was a most unsatisfactory one for the Waimaunga Experimental Farm (Grey Valley). Frequent floods disorganized farm operations and made experimental work ineffectual, besides damaging land and fences. These conditions, of course, affected the dairy herd, and returns suffered in consequence. Twenty-eight cows came in at the commencement of the season, and late calvers increased the number to thirty-two. The average yield of butterfat per cow for the season was 232 lb., compared with 245 in 1925-26.

It was found necessary to dispose of the flock of eighty breeding-ewes, which realized good prices at auction sale. One truck-load of lambs—Border Leicester-Romney cross—was sent to Addington and sold well. They were on the big side for freezing purposes, but were very fine lambs for the local trade.



FAT LAMBS SENT TO ADDINGTON SALE.

As mentioned in last year's report (*Journal*, September, 1926) the grazing of pigs gave good indications for pasture-improvement. To gain further information on this matter it was intended to fence off small areas and graze pigs for a certain period, and note if conditions of improvement were maintained and were worthy of following up. Owing to the difficult conditions it was impossible to fully carry out this plan, but so far as it went a better pasture constituent resulted than by artificial top-dressing alone, and further experimental work along these lines is now in progress. Cocksfoot responded to the treatment very markedly. Summed up briefly, the indications regarding pastures on land of the Waimaunga class are (1) that without lime and phosphates the result is of little value; but, (2) where lime and phosphates have been used in establishing the pasture, or where top-dressing has been done with phosphates and nitrogenous

manures (on ground previously limed), the grazing of pigs will improve the pasture to an easily noticeable extent ; moreover, stock show a preference for this pasture.

The field-crop experiments undertaken included several in the control of swede and turnip diseases, also tests in the manurial top-dressing and liming of pastures, and sundry rotational trials, &c. As already indicated, however, the severe floods experienced either completely destroyed experiments or made accurate work and recording impracticable, and it has therefore been decided not to attempt publication of any details on this occasion.

TURKEY - RAISING.

F. C. BROWN, Chief Poultry Instructor, Wellington.

SUCCESS in turkey-raising depends largely on having the right class of land for the birds to run on. Turkeys do best on fairly high, sloping country that grows tussock-grass and the like, or on flats where the soil is of a free sandy loam with good natural drainage. On low-lying, heavy, damp ground it will generally be found a difficult matter to rear the young stock, especially during a wet season when there is a heavy growth of grass.

Having suitable soil and a generally favourable environment, the next great essential is the quality of the breeding-stock. There must be no doubt whatever as to their constitutional vigour. Birds that have been late hatched or stunted in growth should never be used for breeding, for, if so, trouble is almost sure to be experienced in rearing the young stock. It is a common but mistaken practice to use all or any members of a flock for breeding-purposes. A vigorous strain can only be built up and maintained by careful selection of the strongest specimens for renewal of stock.

It is also important that the stock are not inbred. Breeding from birds that are too closely related is probably more responsible for mortality in young turkeys than any other cause. If turkeys are to have the power to resist the many troubles and diseases to which they are liable it is important that a fresh male from an unrelated strain be introduced at least every third season. During recent years several breeders have imported fresh blood of the Bronzewing breed from America, and have now the progeny available for disposal, so that there is no excuse for any one continuing to breed from birds that are too inbred. Whether it be the male or the female, it is a mistake to breed from birds until they are about two years old. Although it is common for first-year birds to be bred from, these seldom or never produce vigorous progeny.

In general it is a difficult matter to rear turkeys successfully when confined to a run, especially if the breeding-stock do not possess undoubted constitutional vigour and are not thoroughly domesticated. If the best results are to be obtained the birds should be allowed a free range, at any rate during the day, the whole year round. Of course, on small holdings and where there is a danger of their destroying a crop in the ripening stage, and particularly one belonging to a neighbour, then it may be found necessary to confine the birds in a

wire-netting enclosure. Where it is found really necessary to do this the larger the run provided the better will it be for the welfare of the birds.

In the mating of turkeys one male bird should be allowed to every eight to ten females. Turkey-eggs take about twentyeight days to hatch, and usually from seventeen to twenty eggs are sufficient for the hen to brood properly. Where breeding-turkeys are allowed to range it is a good plan to let the hen select her own nest and bring out her own chicks. When she has commenced to sit, care must be taken to disturb her as little as possible. It is a good plan to have food and water close by, so that she can come off the nest and obtain feed and water at will.

After the poults have been hatched for about twenty-four hours both the hen and her brood should be placed in a large open-fronted watertight coop made free from cracks in the sides and back walls as a preventive against draughts. In this way the birds are provided with plenty of fresh air without harm. Better far to have the birds in the open than in a coop through which the wind blows. Draught is as fatal to young poults as it is to chickens or ducklings. A suitable coop can be made on the lean-to style—say, 3 ft. square, 2 ft. 6 in. high in front, and 2 ft. at the back. The front of the coop should be covered with 1-in.-mesh wire netting, with a door consisting of a light frame covered with wire netting. The coop should have a wooden bottom raised slightly above ground-level. This will prevent the hen and her brood from getting swamped out if very wet weather conditions prevail.

For the first few days both the hen and poults should be confined to the coop, and during the next week the coop should be arranged in such a way that the young ones can have their liberty. This can be easily arranged by having a hinged board at the bottom of the door, which can be opened up or closed as required. By this means the poults are encouraged to take exercise, an essential for healthy growth. Many breeders, especially where the birds are being reared under semi-confined conditions, have a movable wire-netting run in conjunction with the coop. Thus the coop and run can be frequently removed to fresh ground, while in addition the young ones are protected from cats, weasels, &c., until they reach a safe age. Here may be emphasized the importance of clean ground; it is merely courting disaster to try and rear young turkeys on tainted soil. Unless the birds are being bred on an absolutely free range and in a natural way a brood coop such as described is invaluable. It is true that the mother hen can be depended upon to protect her young during the heaviest of rainstorms, but if they are later trailed through long wet grass the mortality is almost sure to be great.

Young turkeys require no food for at least twenty-four hours after being hatched. Then for the first few days they should be given stale bread soaked in milk and squeezed dry, in which some hard-boiled egg, finely minced, has been mixed. As a change they can have rice that has been boiled in milk. As the birds develop they may be given a mash made of finely-ground wheat, bran, maize-meal, and oatmeal. The food must be mixed to a dry consistency. When the poults are four weeks old they should be fed three times a day with mixed broken grains such as wheat; maize, or barley. Young poults are always

slow to take food, and it is a mistake to try and force them to eat. They have small crops, and require to be fed frequently, but only a little at a time. Young turkeys should be fed on flat wooden trays and not on the ground. On no account should mash food be left before them to become fermented, or bowel trouble is almost sure to follow. Clean water or milk should be given from the outset, and left before the birds at all times, while an ample supply of grit is essential for both old and young stock. Milk is a valuable drink as well as a food for young turkeys. Where this is provided special care must be taken to keep the containers in a thoroughly clean state. Finely-chopped green-stuff, such as lettuce, young onions, or dandelion-leaves, should be fed daily. Charcoal is also good for turkeys, and should be freely provided to birds of all ages.

One of the chief points in rearing young turkeys is to keep them free from vermin. To guard against these the sitting turkey should be well dusted with insect-powder before commencing to sit, and again before the pipping stage, while during the time she is rearing an occasional dusting will do good. The hen should not be dusted when the poults are very young, as the powder may get into their eyes and cause blindness. Where the hen is sitting in a dry place, and particularly when the weather is warm and dry, it is a good plan to keep the soil under the nesting-material slightly moist, especially at pipping-time. This will prevent the membrane lining of the shell from becoming so tough and dry that the young bird is unable to pierce it—a common cause of fully-developed chicks dying in the shell.

Where turkeys are being kept on a limited area of land and are allowed a free range at all times, or even during the day, they will pick up a great part of their living in green material, seeds, insects, &c. It is, however, a good plan to give them a light meal at regular times in the morning and evening, as this will encourage them to come home at night. Turkeys are great wanderers, and if not induced to come home at night to obtain food there is no telling where they may roam to if they have the opportunity. A suitable meal may consist of a mixture of grains such as wheat, maize, oats, &c.

In most parts of New Zealand turkeys do not require houses to sleep in; the less coddling they receive the better. There is no better place for a turkey to roost than on a rail fence or in a tree. In the management of turkeys any bird that appears sick should be isolated at once, particularly if the bird shows a serious decline in weight and the droppings are a green and yellow colour. These symptoms usually indicate that tuberculosis is present—a disease which turkeys are prone to. When a bird gives definite symptoms of being affected with this disease it should be destroyed and the carcase burnt.

When from eight to ten weeks old the young birds commence to get a red head. This period is one of the most critical of their lives, as from no apparent cause it is then common for them to suddenly die. At this stage the birds should be fed well away from the homestead, in order to induce them to take a maximum of exercise and secure an abundance of natural food. Plenty of chopped onions will be beneficial at this stage. The turkeys should also be encouraged to roost, preferably in trees. A person experienced in rearing turkeys recently informed the writer that he saved the lives of many birds by giving them a drop of port wine when the red head was beginning to show and they had taken a sudden seizure.

SEASONAL NOTES.

THE FARM.

MANIPULATION OF THE REAPER-AND-BINDER.

REAPING-MACHINES should now be overhauled and put in readiness for the approaching cereal harvest. The "binder" is admittedly one of the most complicated machines used on farms, and its manipulation calls for considerable skill, both in the correction of mechanical troubles and in the adjustment of the working-parts so that it continuously delivers straight-butted and well-tied sheaves.

The Reel.—The reel requires continuous adjustment, depending on the height of the crop and the direction in which the crop is leaning. Its function is to bring the crop forward to the knife and over on to the platform. The reel should normally be set so that the vanes strike the crop just below the ears, and do not leave contact till the grain is falling towards the platform. If the grain is leaning away from the knife the reel must be moved forward and down; if leaning towards the knife, moved back.

The Platform and Canvasses.—Under ordinary conditions the platform is run sloped slightly forward to the knife, but its inclination must be altered, depending on the movement of the grain. If the grain tends to mount the elevators heads first, then lower the platform and tilt it backwards; if the grain moves butts first, raise it and run with a forward slope. The platform and elevator canvasses should be carefully attended to. All broken slats should be renewed, and it is usually best to replace any that are at all cracked, as these generally break later on and may hold up the machine. The canvasses must be buckled evenly, otherwise they tend to move to the tighter side, which strains the rollers and breaks the slats. Canvas shrinks when it is wetted, and the canvasses should be loosened each night either by an adjustment lever or by loosening the buckles. On putting the binder away at the end of the season the straps on the canvasses should be carefully oiled.

Binder-deck and Buttor-board.—The elevating-canvasses lift the grain from the platform canvass and deliver it at the top of the binding-deck. The grain is then moved down the packers by the buttor-board situated at the fore end of the binding-deck; an extension of this board straightens the butts of the sheaves. The board is adjustable for long and short grain, but should not be moved with the idea of altering the position in which the band is placed. The position of the band is altered by sliding the binding attachment backwards or forwards. The constant adjustment of the deck to suit varying heights in the crop is very important if the bands are to be properly placed on the sheaves.

Tying-mechanism.—The grain passes down the binding-deck over a length of twine until it reaches the compressor-arm, against which it is packed by three packers until a bundle large enough for a sheaf has been formed. The size of the sheaf is altered by moving the compressor-arm towards or away from the packers. Some machines

have a special trip-lever on the deck of the binder, and in altering the size of the sheaf this lever should be lowered for large sheaves and raised for smaller ones. When the sheaf is being formed the twine is held at one end in the twine-retainer in the knotter-head, and at the other end by the tension-rollers at or near the twine-can. If the tension-rollers hold the twine too tight the free end of the twine may be torn out of the twine-retainer, or the twine may break; if the rollers allow the twine to pass too freely the band is loosely laid round the sheaf. After the tension-rollers have been adjusted to make a straight band the tightness should be adjusted by altering the pressure necessary to set the binding-mechanism in motion. When a binder throws untied sheaves it is usually due to one or other of the following causes: (1) The needle may be bent and fail to pass the twine over the knotter-bills into one of the notches in the twine-retainer; (2) the twine-tension is too great; (3) the twine-retainer is loose and fails to hold the twine while the knot is being tied; (4) the spring of the knotter-bills is too loose; (5) the knife may be dull or out of time.

Driving-mechanism.—The sprocket-wheels and driving-chains should be carefully examined. The wheels should be exactly in line and the chains run fairly slack, as they are liable to break if too tight. All oil-holes should be carefully cleaned out, and to make sure that none is missed it is a good plan to do the entire length of one shaft before going on to the next. When operating a binder it is important to use good oil and lubricate the machine thoroughly. New machines generally require extra oiling

HAYMAKING.

The best time to cut pastures for hay naturally depends on the weather and the type of pasture. When mowing permanent pastures it is generally desirable to cut early, aiming at a light cut of good-quality hay rather than a heavier cut later in the season. Early cutting conserves a closer turf on the pasture than late cutting, which leaves the cocksfoot-plants very tufted, the white clover stunted, and consequently a good deal of bare ground.

The green plants when cut for haymaking contain from 70 to 75 per cent. of water. Before they can be conserved as hay this water content must be reduced to 15 or 20 per cent. The wind and sun are relied on to dry the green material, and of the two the wind is the most satisfactory. There is a very general tendency to allow the hay to be entirely dried by the sun as it lies in the swathes left by the mower. A thin layer of mown grass exposed for long to the bleaching effect of the sun becomes very dry and brittle. If rain falls on the material left in the swathes or windrows to dry, a great deal of the soluble food material is washed out of the hay. Hay of high quality can usually only be obtained when it is cured in cocks, so that it loses its moisture by wind evaporation, retains its green colour, and is not so liable to be spoilt by rain falling during haymaking.

There is a general tendency at the present time to build very large haystacks, regardless of the state of dryness of the material put into the stack. When hay is stacked a slight fermentation takes place which gives rise to heat, and a certain amount of water is evaporated from the warm stack. With damp material this fermentation is more

marked, and a considerable amount of heat is generated. In the case of a stack having so great a diameter and height that the heat produced by fermentation, cannot escape as quickly as it is liberated, the stack will go on rising in temperature till firing or smouldering occurs. Heat will escape more readily from a long narrow stack than from one which, although containing the same amount of material, is shorter and wider. Stacks placed in sheltered corners near plantations are more apt to heat than stacks well out in a paddock and exposed to the wind.

CROPPING OPERATIONS.

On Canterbury and North Otago mixed farms skim-ploughing of grassland for wheat can usually be commenced in December. Old short-rotation pastures usually throw little summer feed after November, and early skimming will not interfere to any extent with the carrying-capacity of the farm. Also, early skimming reduces the pressure of team work during the autumn months and allows the wheat-land to get the benefit of a partial summer fallow.

Roots ridged in October and November will require thinning during the coming month. A proper horse-hoeing preparatory to thinning is very important. Cultivators having three tines should be used—an A-shaped tine to work the middle of the drill, and two L-shaped ones to cultivate near the rows. It is not advisable to use long curved tines near the plants at the early hoeing, as they frequently knock too much earth away from the sides of the drills and leave the roots of the seedlings exposed.

The later sowings of swedes, soft turnips, rape, and other green crops will be made towards the end of December, and care should be taken that the final cultivation of the land does not dry the seed-bed too much. Early ploughing, which allows the weather to help in breaking the clods, is usually much more satisfactory than late ploughing followed by heavy cultivation to force a tilth.

—P. W. Smallfield, B.Ag., *Instructor in Agriculture, Ruakura.*

THE ORCHARD.

SPRAYING OPERATIONS.

FROM the "fruit-set" period onward sprayings in the orchard will be more of a routine nature, much depending on the condition of the trees and the attacks of either fungous diseases or insect pests. Slightly longer periods between sprayings may be given, providing, of course, weather conditions are favourable. It will still be advisable to spray as soon as possible after rain, even if the previous spray has only just been finished.

Thoroughness should now be the main object. Trees are beginning to be fully covered with foliage, getting denser as the season advances. It will take longer to spray the orchard, and more material will be required. Leaving part of a tree or even a branch unsprayed may cause a serious attack of disease in the near future. At this time of the year it is often found that some varieties of apple-trees appear to be sickly, possibly on account of the heavy strain of seed-production.

With the exceedingly heavy blossoming that has taken place this season it will not be surprising if many trees, especially those growing on the poorer soils, are feeling the effects. Foliage appears to lag, and is of a yellowish colour, instead of a good dark green associated with a healthy tree. A little fertilizer, even at this late period, will be beneficial if thoroughly hoed in.

When spraying at this period it may also be advisable to use one of the precipitated sulphurs only, as these sprays act as a general reviver to the tree—more so than ordinary lime-sulphur. Lime-sulphur can be reduced in strength to 1-125; otherwise the spray advised in last month's notes can be used, with the addition of Black Leaf 40 should leaf-hopper put in an appearance. This pest is best controlled when in the nymph stage, and should therefore be sprayed on first sight. Red mite has been on the move for some weeks now, and it is only by thorough applications of lime-sulphur that this pest can be kept in check.

Periodical sprayings with lime-sulphur, 1-125, on stone-fruits for the control of brown-rot will be necessary, continuing up to two or three weeks before the fruit is ready for picking.

Black-spot on pears has been noticed for some time past, and another spraying with either bordeaux or lime-sulphur, according to variety, should be applied.

THINNING OF FRUIT.

Probably one of the most important operations in the orchard about this time is the thinning of fruit. As before indicated, blossoming has been very heavy this year, and a big crop of fruit of nearly all varieties is anticipated. To allow such a crop to mature would be disastrous not only to the future welfare of the tree, but as regards the size of the fruit this season. The common practice is to thin off all the black-spotted fruit; but this, on the present showing, will not be sufficient. The main object is to produce a good crop of uniform-sized fruit suitable for export, and this can only be accomplished by systematic thinning. Better results are always obtained, and there is more money in an average crop of high-grade fruit than in a heavy crop of undersized and inferior fruit.

During the past few years thinning has been done by many growers, but in the majority of cases too many apples have been left on the trees to mature. A common expression heard among growers at picking-time is "I thought I had thinned sufficiently." The fact is that growers do not like to see apparently good apples lying on the ground at thinning-time, but they appear to be quite content to pick them when mature and throw them on the ground rather than cart them to the packing-shed, owing to the unmarketable size. The extra expense, impaired vigour of the tree, lack of colour in other fruits on the tree, breaking of branches, and possibility of a very small crop in the following season, do not seem to be considered.

Thinning should be done as soon as the fruit is well set, thus giving the remainder a better chance to size and colour up properly. Go over the trees in a systematic manner, and where possible space the fruits to a uniform distance apart. Once systematic thinning is

done, the results will be so satisfactory that no grower will neglect the operation in future seasons.

MISCELLANEOUS.

The export of fruit will soon be round again. How many growers can say that everything is ready when that time comes? Every opportunity should be taken to make up cases, overhaul grading-machines, packers' benches, wrapping-paper, wood-wool, nails, &c. See that all stamps, pads, labels, ink, &c., are in readiness—in fact, get everything necessary so that no time will be wasted when the busy season starts.

Small fruits will now be maturing and ready to put on the market. It is advisable to have the "get up" as attractive as possible, and this can only be done by careful sorting and packing, placing each size and quality in its respective grade.

Continue the cultivation of the soil by the use of the disks and harrows, keeping the ground well stirred to a depth of 3 in. or 4 in. All soil-moisture will be needed during the next few months, and it can only be retained in the soil by good cultivation.

An application of nitrate of soda or sulphate of ammonia to any sickly or weak-growing tree will help to restore it to natural vigour.

The question of wiring trees should be considered at this time of the year. A good method is to insert a screw-eye on the inside of each of the branches at the proper height, and draw towards a ring in the centre by means of wire. With this method there is no fear of barking the limbs, or snapping of branches above the wire, as is often the case where wire is wound round the trees.

—G. Stratford, Orchard Instructor, Motueka.

Citrus-culture.

The chief work for the coming month among citrus-trees will be continued tillage for the suppression of weeds and the proper aeration of the soil. Work the soil thoroughly and often to a depth of at least 5 in.; such workings not only permit better root-action, but conserve moisture and induce fibrous roots at a depth where they are not so detrimentally affected by dry weather as those nearer the surface. Strips of land between the trees and right under the branches should be cultivated to the same extent as land between the trees. Aim at clean cultivation and the maintenance of a friable surface-soil condition right through the grove.

As the petals fall from the lemon-flowers it will be necessary to spray with bordeaux, 4-4-40, in order to control verrucosis, which establishes on the fruits as soon as they form. As preventive sprays are the only control for this disease, repeated sprayings are necessary to ensure the covering of all fruits during the long flowering-period.

A summer insecticide of oil, 1-60, or Black Leaf 40, 1-800, is required to ensure a thorough control of insect pests, supplementing the autumn or spring sprayings. Black Leaf 40 may be added to the bordeaux for application.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

AMONG THE STOCK.

THE breeding season for fowls now being over, all male birds should be separated from the hens, which will lay as well, if not better, without the males. Any cocks that show signs of not being serviceable for future breeding should be disposed of at once; it is seldom that a male bird can be depended upon for breeding-purposes after the third year, and the keeping of such stock means a continued drain on the profits. The aim of the poultry-keeper should be to never have on the plant a bird which is not paying its way.

No attempt should be made to rear weaklings. Constitution is the base of disease-resistance and heavy-producing stock. It is therefore obvious that to waste time over a delicate chicken is not only inviting an outbreak of disease but is decidedly unprofitable.

There should be no delay in marking the feet of chickens for age-determination. It is the only means whereby the common mistake of disposing of a young profitable bird and retaining an old unprofitable one may be obviated with certainty.

CARE OF INCUBATORS.

A matter that now requires attention is the thorough cleaning and disinfecting of incubators. The lamps as well as the burners should be washed in boiling water, thoroughly dried, and then, together with the regulating-devices (connecting-rod, &c.), placed inside the incubator. This will not only assure that these parts are in good working-order when required next season, but the life of the incubator will also be greatly prolonged.

INCUBATING AND REARING OF DUCKS.

Where ducks are kept their eggs should now be set without delay for the renewal of the laying flock. Ducks are not nearly so difficult to hatch and rear by artificial means as is generally supposed—that is, provided common-sense methods of management are employed. The temperature during the period of incubation, at the level of the tops of the eggs on the tray, should be 102° F. for the first week; from this on to the pipping stage 103°; and 104° when hatching. If the right degree of temperature is maintained, and the eggs are fairly fresh when set, the ducklings will commence to pip late on the twenty-sixth day and hatch out on the twenty-eighth day. On no account open the incubator and attempt to help the young birds out of the shell unless they have been given their full time to hatch.

During the first week the eggs require very little cooling; after the third day they should be turned both morning and night; usually the time taken to do this is all the cooling they require for the first week. During the second and third weeks the time of cooling should be extended by degrees up to twenty minutes, while during the last week and up to the pipping stage they may be left out much longer. After the fifth day the eggs should be tested and the infertile ones taken out, whilst during the incubation process the eggs should be occasionally tested for the purpose of detecting and removing any with dead germs. Eggs containing the latter soon give off a bad odour, which is apt to injure

the hatching-qualities of the remaining eggs in the machine. Usually the shell of a decaying duck-egg becomes discoloured, and can be readily detected by a person of experience without the use of a tester.

One of the worst difficulties in artificially hatching duck-eggs is getting the air-cell to dry down to a desired line—a common cause of fully-developed ducklings dying in the shell at pipping-time. Trouble from this cause can be prevented by spraying water at a temperature of 103° (with the mouth) on the eggs after the fourteenth day. Do this immediately after turning, and place the eggs back in the machine. Do not cool after spraying; spray in the morning, and cool at night. The incubator-vents should at all times be partly open, so that any excess of moisture not required by the eggs can get away. Generally, no further added moisture is required. The spraying of the eggs not only has the effect of increasing the size of the air-cell, but also softens and weakens the membrane lining of the shell, which assists the young duckling to get out of its prison.

In rearing ducklings—no matter what class of brooder is being used—care must be taken to provide the young birds with an ample supply of fresh air. Without this the mortality is sure to be great. Of course, good ventilation should go hand-in-hand with a uniform degree of warmth—say, 90° at the start, and reduced by degrees as the ducklings develop.

During the first week the food of the young birds may consist of equal parts of scalded bran and pollard mixed with a small quantity of oatmeal, and with 5 per cent. of fine grit (not sand) added. Feed four times a day a quantity that the birds will pick up clean in a few minutes. When the ducklings are about a week old the grit need not be mixed with the food, but it should be always available to them in a receptacle so that they can help themselves.

Finely cut green food should be fed separately after the first week; also at this stage some boiled mincemeat should be given, and increased by degrees as the ducklings develop. As they grow older, feed equal parts of maize-meal, pollard, and bran. It will generally be found best to moisten the mash with hot water until the birds are about two weeks old.

Water should be given with the first meal, and from then onwards it should always be left in reach of the birds, both by day and night. Probably the most common cause of mortality among ducklings is confining them by night in a brooder without water and giving them a heavy drink before receiving their morning meal. Ducklings affected from this cause usually stagger and give every indication of suffering from a fit. The drinking-vessels should be sufficiently deep, so that the birds can wash off any food that may adhere around their nostrils and at the same time give them a good blow-out. Once the nostrils are allowed to clog, the eyes become plastered and the duckling ceases to thrive.

Young ducklings should not be compelled to sleep on damp bedding, or loss of leg-power and other troubles are apt to set in. To prevent dampness the water-fountains should be placed in the run well away from the sleeping-quarters.

—F. C. Brown, Chief Poultry Instructor, Wellington.

HORTICULTURE.

THE TOBACCO CROP.

THE remarks of last month now apply to the later plantings, which should be in position in the field. After the close attention required while the plants were in the seed-beds, the present month comes as a rather welcome interval. However, careful consideration must be given to the preparations for the harvest. Curing-sheds will require cleaning up and refitting. For the benefit of those without experience, it will be well to state the curing practice here is to cut the mature plant down a little above the ground and split the butt to within 2 in. or 3 in. of the end; it is then threaded on to a curing-stick. These sticks are an inch or two over 4 ft. long and 1 in. in diameter. They usually carry from eight to ten plants, and are hung in the shed by resting the ends of the sticks on tier poles. These are strong squared timber, 2 in. by 4 in., lying horizontally, and held in position by bolting them to uprights; they are usually 4 ft. apart both ways. As the loading is done by a man standing on a plank in this scaffolding, it is important that it should be sufficiently strong; serious accidents have occurred through neglecting this point.

If the distance between curing-sticks on the tier-poles is reckoned at 8 in., it is now possible to work out the accommodation required for curing the crop. This is generally short of requirements, and make-shift devices have to be resorted to. Whatever arrangements have to be made, if they are worked out now it will give best results, as there will be no time for planning during the busy harvest period.

FRUIT SECTION.

The harvesting of raspberries and currants black, white, and red commences this month. To keep the two first-named in bearing they must not be allowed to become at all dry. If such conditions are inclined to prevail the plantations should be irrigated. There are many crops of the kind growing on land which is inclined to be drained too quickly in summer that would give a greatly increased yield under irrigation. The strawberry crop also in such cases would benefit from a similar attention.

Summer-prune white and red currants, also gooseberries, as required. Train in the best of the loganberry new wood so that it does not interfere with the bearing-caness, cutting out weak growth.

TOMATO-GROWING.

Tomatoes under glass will now be in full bearing and yielding the most valuable part of their crop. To maintain production careful attention must be given them, especially in the matter of ventilation. The dense bulk of vegetation in the average house at the present time quickly becomes mildewed if the atmosphere is close. The normal plant of this kind prefers a dry buoyant atmosphere, and to maintain this the ventilation must be extended in early morning before the temperature rises. If the plants are normal there is not much danger now of chilling them, except by a decided cold draught. Such attention is an important factor in the prevention of mildew, which so seriously interferes with the functions of foliage as to prevent the fruit from

swelling, and in the worst cases seriously diminishes the crop. The trouble is very serious in the warmer districts. Some houses have been built without giving the ventilators much thought, and they are of small capacity for even a cold climate. Under such conditions the plants come away particularly well until about the end of October, when they have attained about two-thirds of their mature height; then under the conditions of a close atmosphere and high temperature mildew breaks out seriously.

Plans of glasshouses in other countries may be of great interest to us, and the extensive ranges built about the larger centres of population in cold countries have many interesting new features in construction and heating, but in adopting a design we must see that it is adapted to our local conditions and the crop we wish to grow. A glasshouse 14 ft. wide, without ventilation, in a colder country may grow very good cucumbers, but to build in the warmer districts here a similar house, but of twice the width, and to expect to grow tomatoes in it is sure to bring a very disappointing experience. There is probably no glasshouse crop in which the foliage is so dense and the proportion of air-space so small as the average tomato crop under glass in summer. Any one who knows anything of the importance of light and air in the economy of plant function will realize the difficult task before the grower in his desire to successfully ripen the large crops without delay. Where this trouble is serious the grower should carefully study the position, and so learn all that is possible from the unpleasant experience, and make plans for the necessary alteration.

Feeding the plants at short intervals with liquid fertilizers will improve the quality and quantity of the crop. The standard packing of tomatoes for a whole district is a very fine ideal worth considerable sacrifice to obtain, but meantime a grower will be wise to standardize his own pack and see that each box contains an even grade of a distinct class. The wholesale buyer's first business is to learn the brands being marketed and allot to each a reputation. The most payable reputation is probably that for a clean, consistent pack that is true to label.

The outside crop will need suckering and tying. Meanwhile keep a sharp lookout for disease, and spray as necessary. In some instances it will pay to carefully remove infected plants or leaves and burn them.

MARKET-GARDENS.

When lifting the early potato crop it will often pay well to carefully select the seed tubers from the best stools; in this way true seed of high strain is obtained. Tubers of the size of a hen's egg are most desirable, but larger ones may be cut when planted. Too often good land and careful attention are given to mixed seed of inferior quality. In some districts late blight is prevalent in the main crop, and it is necessary to spray with bordeaux. This treatment should now be commenced, as the danger period is at hand; 4-4-40 is the usual formula, but this may be increased to 5-5-40 or 6-6-40 for the following applications, which are made at intervals of two to three weeks.

Important work now is the consideration of the winter crops of celery, leeks, savoy, broccoli, and cauliflowers. The plants in the seed-beds will soon be ready for setting out. Water the beds well

the day before lifting the plants, which should afterwards be lifted with care and stood in tin trays for removal to the field. This should be done towards the end of the month. Meanwhile the preparation of the land should be completed as soon as possible. In moist land with plenty of humus extensive plantings of celery could well be made. The modern commercial method is to set the plants 6 in. apart in shallow furrows 3 ft. to 4 ft. apart, and later blanch the stems by moulding them up. In the warmer districts cauliflower might well take the place of broccoli, which, although hardier, takes a long time to mature.

* On land inclined to be dry it is well to remember that the lettuce, cucumber, and marrow crops require ample supplies of water at this season. If this requirement is supplied occasionally, together with suitable fertilizers, the results will be satisfactory. Pinch back the leading shoots of the gourds in order to produce lateral growth and thrifty plants.

A halt should now be called to the pulling of rhubarb and cutting of asparagus. Feed up the beds well, and see that they do not lack necessary moisture. By building up the plants now the following spring crop will be enhanced.

MANURE ECONOMY.

The relationship of stock to the successful cultivation of the soil is important, and demands more consideration if the highest economy in crop-production is to be realized. The supply of organic manures has decreased, but that is all the more reason why the most should be made of what is available. Before application to the land this class of manure should be well decayed. When fresh or dry it is comparatively useless, and the danger of introducing a crop of bad weeds is great. To produce the required decayed condition it must be placed in a compact heap and kept moist, so that the necessary fermentation will be induced. This is best done on a sloping concrete floor in a sheltered position, when, if a convenient sump is built, the drainings may be used with advantage as a liquid manure on many crops. Manure from the poultry-pens may be stored in concrete bins and covered occasionally with earth. Sometimes it is allowed to dry out, and it is then put through a mill and ground fine, and used in much the same way as a chemical fertilizer.

Successful plant-production consists very largely in a skilful use of manures, but an important factor is obtaining a cheap supply of good quality. Conservation and treatment of all available supplies should now be made in readiness for the heavy demands in early winter. Growers situated near the sea-coast where quantities of seaweed are available should remember that this material is about equal to farm-manure as a soil-dressing. Soot and wood-ashes, if kept dry, are also valuable.

Another waste material that might be put to more economical use is the trimmings and trash that form an unsightly heap in most gardens and plantations. Stacked on rough logs to keep it off the ground and from decaying, it would serve a useful purpose if during the winter it were spread over a piece of land to be used later for seed-beds and burnt. In this way it would sterilize the

soil, and add to the latter useful quantities of charcoal and potash that would very much benefit subsequent crops.

—W. C. Hyde, *Horticulturist*, Wellington.

THE APIARY.

BROOD-REARING AND QUEEN-EXCLUDERS.

WITH the advent of December all danger of the bees dying of starvation should be over. If the bees have received the required attention, work should have progressed in the first super, and some of the stronger colonies may require even more room. Where excluders are not being used the queen, if young and vigorous, will probably be making use of at least three of the centre combs in the super. This is no cause for regret; it is rather a good sign, provided the combs in the brood-chamber are fully occupied with brood. A good young queen requires more laying-room than is provided in a ten-frame brood-chamber. If it is desired to use excluders to ensure that all combs in the super are free from brood at extracting-time, that objective can be attained by inserting the excluders a month before it is proposed to extract. By that time the swarming season will be practically over, and, as the queen will not be laying quite so freely, less room will be required for brood.

SWARMING-CONTROL.

The putting-on of the first super will have checked the first impulse to swarm, but difficulties in this connection are not over, and further measures will be necessary. Various schemes have been introduced from time to time to control swarming, and some of them have received considerable support even from commercial beekeepers. The method adopted must be largely determined by local conditions. The bees require considerably less attention in districts favoured with a light or medium honey-flow extending from November to March. In some parts of the Dominion the flow is confined to a few weeks from mid-December to the middle of February at the longest, and the flow during that time is very erratic. Sometimes the nectar is coming in so fast that the bees appear to become frantic in their endeavours to find room for it. Every available cell is filled, with the result that the queen is restricted in her laying and the swarming impulse engendered. If every colony is headed by a young queen, swarm-control is then simply a matter of providing plenty of room for the use of the queen, and the storage of honey, and ventilation.

The method adopted successfully by some beekeepers, and known as the Demaree system, consists in lifting the brood, with the exception of two frames containing open brood and the queen, over an excluder. This plan is open to objection owing to the fact that too large a proportion of the bees go into the super and remain on the brood. The combs in the brood-chamber are not cleared up, nor is the foundation drawn out for the use of the queen, with the result that her laying is restricted. This difficulty can be overcome very largely by placing a super of empty combs immediately over the brood-chamber, and the brood as a second story on top. Queen-cells will be started on the brood, and if these are not required they should be destroyed.

Many commercial beekeepers control swarming adequately by simply drawing the bees up into further supers. When the first super

is about three-parts full, lift it off and put the new super, containing drawn combs or frames fitted with full sheets of foundation and one frame of brood taken from the brood-chamber or from the centre of the first super, in its place. Then place the first super on top. When this new super is about three-parts full, put on still another immediately over the brood-chamber, fitted as recommended in the case of the first two supers.

ARTIFICIAL INCREASE.

This is accomplished by simply dividing established colonies and furnishing each queenless portion with a ripe queen-cell or, preferably, a laying queen. If a maximum of increase is desired, irrespective of a crop of honey, each colony can be divided to form a number of nucleus colonies each containing two frames of brood and one empty comb. Each division, with the exception of the portion remaining on the site of the old hive, should be shut up for three days, otherwise practically the whole of the field-bees will forsake the newly formed nuclei and return to the site of the old colony. Do not unduly confine a young laying queen to a limited number of frames, but give the additional combs when required. A queen-bee ages prematurely if prevented from functioning naturally.

FOUL-BROOD.

Every colony affected with this serious disease should be treated immediately the honey-flow commences. Approved treatment consists in shaking all the bees on to frames containing a narrow strip of foundation, and four days later brushing them from the pieces of comb they have built on to frames fitted with full sheets of foundation. If there are a number of colonies to be treated the brood can be placed over an excluder put on one of the weaker colonies, and, when all the brood has hatched out, treated in the usual way. The combs, if not too badly infected, may be melted into wax, and the frames sterilized by immersion for a few minutes in boiling water and used again. The utmost care, however, must be exercised to keep all infected material out of the way of the bees. Section 3 of the Apiaries Act provides that "every beekeeper in whose apiary any disease appears shall, within seven days after first becoming aware of its presence, send written notice thereof to any Inspector appointed under this Act."

BIG HONEY-YIELDS.

At the annual conference of beekeepers held at Christchurch last June the writer referred to the excellent honey season that had been experienced in Canterbury and the good crops taken in the district. A case was instanced in which a beekeeper had taken 22,400 lb. from 190 colonies of bees. While such crops are above normal, they tend to show that Canterbury can, in common with other districts, produce large crops of honey when the weather conditions are normal. Now comes a report from South Canterbury of a crop taken from sixty colonies, where the total yield amounted to 19,040 lb. of white honey, or an average of 317 lb. per colony. In addition the bees were placed in winter quarters with an average of 45 lb. of sealed honey for each hive. This return may rank as a high-level record for New Zealand, and is here chronicled in order that such a mighty effort on the part of the little honey-bee should be well recorded.

—E. A. Earp, Senior Apiary Instructor, Wellington.

TESTING OF PUREBRED DAIRY COWS.

C.O.R. LIST FOR JULY TO OCTOBER, 1927.

Dairy Division.

THE time of year has now been reached when the majority of our certificates of record are issued. The appended list contains particulars of 178 records, the greater proportion of the certificates represented having been gained during the past month. Apart from its numerical strength, the list is of more than usual interest on account of the number of outstanding performances recorded, including three which constitute new class-leaderships and one 1,000-lb.-butterfat yield. Monavale Queen Bess, the 1,000-lb.-butterfat cow, was commented upon fully in last month's *Journal*, and some notes regarding the new class-leaders are now given.

IVONDALE OXFORD LASS.

The leadership of the junior two-year-old Jerseys now goes to Ivondale Oxford Lass, with 731.29 lb. of butterfat, replacing Mr. G. F. Yelchich's Keston Flower by a margin of 37.01 lb. butterfat. Ivondale Oxford Lass was bred by Mr. P. J. Petersen, of Brixton, Waitara, but was sold to Mr. R. S. Tuck, of Waharoa, under whose ownership her C.O.R. test was conducted. She is by the imported sire Xenia's Oxford Lad, and her dam is Ivondale Rainbow's Lass, who has gained two certificates of record. Ivondale Rainbow's Lass is a daughter of Ivondale's Rainbow—sire of seven C.O.R. daughters—and is a half-sister of Ivondale Golden Rainbow, leader of the senior two-year-old Jerseys. The new leader commenced her test at the age of 1 year 338 days. Considering her age, the performance is an especially fine one, and will be difficult to displace. Her milk-yield was 12,107.7 lb., and she was milked three times daily during practically the whole of her test period.

MATANGI MATILDA 4TH.

The second new class-leader appears in the junior four-year-old Milking Shorthorns, Matangi Matilda 4th, with 630.38 lb. butterfat, having increased the record by some 22 lb. over that of Matangi Nancy 2nd. As her name conveys, Matangi Matilda 4th was bred by Messrs. Ranstead Bros., of Matangi, but during the testing-period just concluded she was owned by Hon. Mrs. E. J. Blyth, Kohimarama, Auckland. She is from Matangi Matilda 2nd by Dominion Glaxo of Ruakura. Her maternal grandsire is the well-known Dominion Esau of Ruakura, sire of fourteen C.O.R. daughters, several of which are class-leaders. He will also be remembered as sire of Matangi Quality 4th, one of the most outstanding Milking Shorthorn cows in New Zealand.

Passing reference may also be made here to Braeside Sweet Nell 2nd, also appearing in the Milking Shorthorn list, whose record of 851.21 lb. butterfat is only a few pounds below that of Glenthorpe Lady, the mature class-leader of the breed. Braeside Sweet Nell 2nd was bred by Mr. W. H. Carter, Auckland. During her testing-period she was herd-mate of Matangi Matilda 4th and owned by Mrs. Blyth.

WAYWARD 6TH B NO. 1.

The Red Poll cow Wayward 6th B No. 1 goes to the head of the four-year-old class, increasing the previous record by no less than 131.57 lb. butterfat. She succeeds Susie Ann (448.48 lb. butterfat) tested by Mr. B. W. Harvey, Waverley. Wayward 6th B No. 1 is also leader of the two-year-old Red Polls, her two-year-old record being 511.42 lb. Her performances both as a two-year-old and as a four-year-old are the highest for the breed in New Zealand. She was bred by Sir R. Heaton Rhodes, Tai Tapu, but was owned by Mr. G. S. Young, West Plains, Invercargill.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat reg'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS.

<i>Junior Two-year-old.</i>		Yrs. dys.	lb.		lb.	lb.
Ivondale Oxford Lass*	R. S. Tuck, Waharoa ..	1 338	240.5	365	12,107.7	731.29
Te Aute Annie ..	W. T. Williams, Pukehou ..	1 324	240.5	365	10,076.9	662.81
Marairohia Fancy* ..	G. E. Yelchich, Waiuku ..	1 314	240.5	365	9,996.1	651.42
Meadowvale Nonette ..	R. S. Tuck, Waharoa ..	2 12	241.7	365	9,450.2	603.42
Princess Mermaid* ..	G. E. Yelchich, Waiuku ..	1 303	240.5	365	11,239.1	581.07
Ngahiwi Romantic ..	W. J. Freeth, Pukearuhe ..	2 2	240.7	365	9,681.5	552.73
Pinewood's Viola ..	G. H. Bell, Oakura ..	1 320	240.5	336	8,689.6	525.94
Kahuwera Bo-peep ..	Johnson Bros., Te Awamutu	2 40	244.5	365	8,212.5	512.58
Rydal Robin ..	T. M. Remington, Westmere	1 330	240.5	365	9,917.2	510.19
Jersey Bank Bonny ..	J. J. Goodwin, Morrinsville	1 360	240.5	333	9,215.2	506.56
Jerseydene Fairy ..	T. Wells, Dargaville ..	2 42	244.7	365	8,071.8	498.10
Queen Betty ..	Mrs. E. E. Burgess, New Plymouth	2 3	240.8	365	9,171.5	494.06
Ngahiwi Exile's Secret	W. J. Freeth, Pukearuhe ..	1 330	240.5	365	8,791.3	487.47
Velebit Silver Maid ..	G. E. Yelchich, Waiuku ..	1 303	240.5	365	8,462.3	486.01
Linden Grove Lovely	Mrs. M. A. Gadsby, Stratford	1 360	240.5	365	7,481.0	476.31
Poneke Hope ..	C. S. Leggett, Motumaoho..	1 349	240.5	365	7,955.9	462.54
Glenavon Joffre ..	J. Townsend, Puni ..	1 278	240.5	365	8,890.8	449.94
Brentwood Queen ..	C. A. Willis, Pukekohe ..	1 306	240.5	365	7,728.5	446.09
Brentwood Peggie ..	C. A. Willis, Pukekohe ..	1 349	240.5	365	8,318.0	430.28
Invergourie Sweet Bye Bye	J. C. Davidson, Dannevirke	1 334	240.5	365	8,350.8	430.11
Floral Lark ..	Mrs. A. M. Irwin, Puni ..	1 316	240.5	348	7,197.0	419.64
Holly Oak Silhouette ..	F. Jennings, Mauriceville ..	1 273	240.5	344	8,439.5	418.25
Rydal Tui ..	T. M. Remington, Westmere	1 351	240.5	293	7,187.9	413.27
Ivondale Heather Brae	G. R. and H. Hutchinson, Auckland	2 16	242.1	362	6,246.4	412.41
Bonnie Primrose ..	J. J. Goodwin, Morrinsville	1 269	240.5	349	5,994.8	403.28
Marshlands Stylish Betty	W. J. Chynoweth, Pukeroro	1 361	240.5	365	5,840.8	403.15
Koro Koro Topsy ..	Mrs. Southee and Sons, Kiwitahi	1 355	240.5	365	6,659.0	403.06 ₂
Fern's Oxford Aldan	G. R. and H. Hutchinson, Auckland	1 337	240.5	357	6,065.5	401.22
Glenwillow Lassie ..	A. J. K. Campbell, Matakana	1 326	240.5	365	7,953.2	400.27
Alfalfa Perfection ..	Cook Hospital Board, Gisborne	1 326	240.5	310	6,259.9	399.91
Kuranui Margaret ..	O. Glynn, Morrinsville ..	1 331	240.5	365	6,057.5	397.99
Oxford Dale Plume ..	J. T. Entwisle, Cambridge..	1 347	240.5	297	5,530.2	389.22
Koro Koro Sea Queen	Mrs. Southee and Sons, Kiwitahi	1 363	240.5	364	7,119.0	371.97

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS—continued.

<i>Junior Two-year-old—continued</i>		Yrs	dys	lb.	lb.	lb.	
Ivondale Gold Chain	C. J. Masters, Hunterville	1	352	240·5	342	8,189·0	369·15
Belswardyne Nell	Mrs. Southce and Sons, Kiwihahi	1	280	240·5	305	5,978·5	366·68
Marshlands Cream	W. J. Chynoweth, Pukeroro	1	337	240·5	305	6,580·1	364·62
Coniston Bilberry	R Waterhouse, Papakura	1	205	240·5	351	5,908·5	362·84
Burrwood Beatrice	J. B. Tonar and Son, Northcote	1	327	240·5	305	6,862·6	346·48
Celia of Aria	M V Reeve-Smith, Aria	1	322	240·5	262	5,525·8	345·21
Holmvalde Heather	J. W. Topham, Temuka	1	330	240·5	364	6,303·9	335·54
Meadowvale Limelight	T. W. Perger, Waitara	1	350	240·5	326	5,150·4	334·51
Brookley Princess	W Johnson, Ngaere	1	349	240·5	312	5,329·0	333·37
Holly Oak Sylvia	T. H. Western, Bell Block	1	320	240·5	322	6,294·4	331·08
Marshlands Jewel	W. J. Chynoweth, Pukeroro	1	246	240·5	305	5,263·9	319·95
Bettina	D Marra, Dargaville	1	210	240·5	355	5,743·2	319·74
Marshlands Elina	W J Chynoweth, Pukeroro	1	325	240·5	305	4,197·8	318·75
Te Aute Tiny	W. T. Williams, Pukehou	1	327	240·5	252	5,865·9	315·69
Pukepapa Molly June	H. Cole, Tikorangi	2	10	242·1	300	4,220·3	310·24
Tyntesfield Iris	R. K. Garland, Okauia	1	292	240·5	313	5,492·5	297·86
Marshlands Star Lady	Mrs. M. A Wright, Piarere	1	225	240·5	294	4,608·8	287·41
Armon Neateyes	E. Beech, Matapu	2	23	242·8	276	5,241·5	270·61
Longview Fortune	Brakenridge Bros, Taupaki	2	18	242·3	268	5,084·0	260·26
Kelvin Sunshine	G. Buchanan, Paeroa	1	252	240·5	321	4,452·6	250·47
<i>Senior Two-year-old.</i>							
Rosina Buckman	A. S W Hazard, Waimate North	2	332	273·7	305	11,187·6	675·82
St. Lambert's Superior	Boon Bros, Poroporo	2	314	271·9	363	9,135·8	593·79
Glen Willow Tirhe	A. J. K. Campbell, Matakana	2	324	272·9	365	9,514·3	548·79
Cloudland's Tyrrel	R Harper, Otorohanga	2	330	273·5	365	9,395·5	522·43
Bo-peep's Lassie	R. A. Lewis, Dargaville	2	361	276·6	341	8,165·9	515·51
Linden Grove Lucinda	A. S. W. Hazard, Waimate North	2	363	276·8	365	10,385·3	514·19
Mermaid's Perfection	A. E. Sly, Whakaronga	2	318	272·3	365	9,395·6	503·83
Bandy	F. Phillips, Otorohanga	2	290	269·5	365	8,760·0	496·70
Aldan's Royal Neat-head	O. J. Lancaster, Palmerston North	2	331	273·6	365	7,014·4	480·02
Lisbury Royal Maid	Mrs. M. A. Jennings, Mauriceville	2	232	263·7	305	7,800·0	473·78
Seacliff Magnet	A. S. W. Hazard, Waimate North	2	313	271·8	353	8,145·9	453·97
Glenbriar Frisky	G. Taylor, Ngarua	2	282	268·7	365	7,329·5	432·77
Oakland's Lilabelle	T. H. Western, Bell Block	2	272	267·7	338	6,220·4	431·17
Vernon Golden Petune	G. R. and H. Hutchinson, Auckland	2	50	246·4	335	6,733·6	426·56
Rozel's Una Sweet	J. J. Goodwin, Morrinsville	2	321	272·6	327	6,176·6	401·59
Brown Bess	C. A. Willis, Pukekohe	2	328	273·3	365	6,349·7	394·45
Te Aute Sybil	W. T. Williams, Pukehou	2	363	276·8	339	6,334·1	381·58
Koro Koro Clematis	Mrs. Southce and Sons, Kiwihahi	2	314	271·9	365	6,748·0	360·12
Dalethorpe Fairy	A. R. Clark, Hamilton	2	346	275·1	298	5,901·4	357·33
Jersey Meadows Grace	W. H. Ridge, South Norsewood	2	341	274·6	323	6,433·4	346·81
Honeyfield Fancy	W. H. Ridge, South Norsewood	2	322	272·7	318	6,273·4	346·71
Kowhai Dewdrop	W. R. Jamieson, Bull's	2	331	273·6	347	5,510·2	334·67
Corra Lynn Tinopai	A. Best, Bombay	2	277	268·2	203	4,725·3	272·64

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.			
				Days.	Milk.	Fat.	
JERSEYS—continued.							
		Yrs.	dys.	lb.	lb.	lb.	
Three-year-old.							
Ashley's Bud ..	W. T. Dazeley, Pukekohe ..	3	54	282.4	365	12,899.4	682.75
Auroa Primrose ..	J. C. Duff, Auroa ..	3	221	299.1	365	9,871.8	652.65
Oak Farm Wonder Girl ..	G. B. Knowles, Tariki ..	3	330	310.0	364	10,184.7	626.68
Reid Park Light of Day ..	C. A. Willis, Pukekohe ..	3	343	311.3	365	10,265.5	596.71
Glenavon Princess ..	J. Townsend, Puni ..	3	256	302.6	365	10,101.7	593.75
Brentwood Lady Madge ..	C. A. Willis, Pukekohe ..	3	338	310.8	365	10,231.6	589.07
Golden Seniorita ..	A. G. Buchanan, Palmerston N. ..	3	263	303.3	365	8,899.0	573.34
Pinewood's Golden Girl ..	G. H. Bell, Oakura ..	3	278	304.8	365	9,689.5	560.16
Hilltop Best ..	A. S. W. Hazard, Auckland ..	3	27	279.7	365	9,335.1	547.53
Brooklyn Moon Moth ..	H. J. Lancaster, Glen Oroua ..	3	314	308.4	365	9,642.1	524.70
Fern Grove Lady Elfie ..	T. W. Perger, Waitara ..	3	343	311.3	350	8,568.0	524.68
Rosedale Sweet Marie ..	E. J. Adams, Puni ..	3	32	280.2	358	8,364.9	491.01
Jersey Meadows Duchess ..	H. H. Phillips, Te Rehunga ..	3	296	306.6	365	8,834.1	469.50
Teasler ..	M. G. McArthur, Auckland ..	3	355	312.5	365	9,735.0	447.34
Vernon Cherry Bloom ..	G. R. and H. Hutchinson, Auckland ..	3	318	308.8	298	8,086.2	428.28
Tamaki Flo ..	A. E. Peppercorn, Cambridge ..	3	196	296.6	293	6,337.7	421.34
Okauia Lady's Maid ..	R. K. Garland, Okauia ..	3	301	307.1	364	8,027.5	402.13
Lass's Buttercup ..	R. Harper, Otorohanga ..	3	332	310.2	352	7,023.1	398.51
Merrie Meade Encore ..	W. T. S. Wilson, Otahuhu ..	3	319	308.9	332	7,530.0	394.05
Armon Monica ..	E. Beech, Matapu ..	3	31	280.1	319	7,742.9	389.31
Marshlands Golden Fern ..	Mrs. M. A. Wright, Piarere ..	3	294	306.4	365	7,120.9	360.76
Rosy Creek Marjorie ..	E. Beech, Matapu ..	3	350	312.0	316	7,185.4	354.18
Four-year-old.							
Oak Farm Princess Mary ..	G. B. Knowles, Tariki ..	4	334	346.8	365	11,098.8	684.43
Staccato Blue Bird ..	H. Hyland, Hastings ..	4	290	342.5	365	10,711.4	650.08
Miss Doreen ..	R. Haylock, Ngaere ..	4	32	316.7	365	10,926.7	604.61
Brentwood Dainty ..	C. A. Willis, Pukekohe ..	4	290	342.5	365	10,083.5	596.79
Pukaki Rose ..	W. Robinson, Patumahoe ..	4	240	337.5	362	10,425.5	573.52
Poplarvale Vesta ..	R. C. Henry, Bell Block ..	4	285	342.0	365	9,158.6	564.65
Silver Pet's Daphne ..	F. P. King, Hautapu ..	4	3	313.8	365	8,856.2	525.05
Poplarvale Heather ..	R. C. Henry, Bell Block ..	4	347	348.2	365	8,458.4	510.57
Tot ..	J. Mitchell, Hopelands ..	4	137	327.2	309	9,449.4	509.28
Brentwood Favourite ..	C. A. Willis, Pukekohe ..	4	317	345.2	365	7,638.0	502.74
Madam Fox of Heathcote ..	H. W. Le Bailly, Buckland ..	4	327	346.2	365	10,354.2	485.78
Abberley Sybil ..	T. Ranford, Whakaronga ..	4	360	349.5	365	9,332.2	467.86
St. Aubin's Galanthus ..	J. Torbet, Waiau Pa ..	4	211	334.6	332	8,810.8	458.29
Springvale Bright Eyes ..	E. Beech, Matapu ..	4	15	315.0	329	8,581.2	442.06
Matai Nui Diadem ..	C. J. Startup, Eltham ..	4	290	342.5	336	6,726.5	413.61
Bonne Lass ..	J. Torbet, Waiau Pa ..	4	340	347.5	352	7,733.4	401.09
Koro Koro Empress ..	Mrs. Southee and Sons, Kiwitihi ..	4	7	314.2	365	6,783.8	385.00
Mature.							
Oaklands Golden Tulip ..	F. W. Cornwall, Bell Block ..	5	216	350.0	365	12,037.4	717.87
Berenice ..	R. Haylock, Ngaere ..	7	354	350.0	365	11,412.1	700.61
Jersey Brae Royalty ..	W. Robinson, Patumahoe ..	5	360	350.0	365	10,306.3	693.70
Oak Farm Mademoiselle ..	G. B. Knowles, Tariki ..	5	281	350.0	364	10,965.4	687.62
Oak Farm Sylvie ..	G. B. Knowles, Tariki ..	5	356	350.0	365	12,017.8	685.93
Brooklyn Golden Lassie ..	H. J. Lancaster, Glen Oroua ..	5	4	350.0	365	10,536.7	644.37

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk	Fat.

JERSEYS— <i>continued.</i>						
		Yrs. dys.	lb.		lb.	lb.
<i>Mature</i> — <i>continued.</i>						
Viola's Fair Lady ..	R. Harper, Otorohanga ..	5 295	350·0	365	9,092·5	632·02
Silver Flower's Ruby ..	R. Harper, Otorohanga ..	6 112	350·0	365	9,384·0	620·82
Jersey Brae's Dainty ..	W. T. S. Wilson, Otahuhu ..	7 320	350·0	365	9,242·3	607·70
Jewel's Winsome ..	W. Devine, Palmerston N.	6 300	350·0	362	11,669·5	595·61
Fair View Daisy ..	W. T. Williams, Pukehou ..	6 361	350·0	364	9,706·3	552·60
Lady Magdala ..	C. J. C. Powell, Opuawhanga	5 354	350·0	365	10,297·0	550·50
Falconite's Joy ..	Mrs. A. M. Irwin, Puni ..	7 05	350·0	365	11,983·3	531·54
Abberly Maid ..	T. Ranford, Whakaronga ..	6 335	350·0	365	10,158·4	521·72
Jollification ..	Mrs. R. Henry, Omata ..	5 263	350·0	354	8,164·6	513·17
Silver Flight ..	N. Moore, Tapanui ..	6 47	350·0	301	9,870·9	510·53
Poplarvale Bluebell ..	R. C. Henry, Bell Block ..	5 322	350·0	351	7,517·3	491·62
Silkworm ..	J. Malone, Riverlea ..	6 364	350·0	327	8,780·3	478·22
Lady Totara ..	W. Devine, Palmerston N.	9 25	350·0	325	7,549·9	472·61
Cloverlea Mahoe ..	J. Malone, Riverlea ..	5 246	350·0	363	9,128·5	470·67
Portia ..	C. J. C. Powell, Opuawhanga	10 227	350·0	365	6,841·2	449·55
Joyance ..	Mrs. R. Henry, Omata ..	8 174	350·0	357	8,392·5	448·85
Spec's Marigold ..	J. Torbet, Waiau Pa ..	5 14	350·0	308	8,263·9	441·29
Silver Queen's Beauty ..	A. E. Sly, Whakaronga ..	6 97	350·0	349	9,721·7	421·13
Cowslip's Gipsy ..	M. V. Reeve-Smith, Aria ..	5 287	350·0	270	9,072·9	402·84
Maori Beauty's Doreen ..	W. T. Williams, Pukehou ..	5 258	350·0	217	8,712·5	401·35
Campania ..	C. J. C. Powell, Opuawhanga	11 267	350·0	365	6,747·7	399·97
Sylvia, K. G ..	R. K. Garland, Okauia ..	6 341	350·0	315	7,891·6	388·91
Koro Koro Duchess ..	Mrs. Southee and Sons, Kiwitaui	7 21	350·0	365	7,805·3	366·12
Roslyn Twin Girl ..	J. Torbet, Waiau Pa ..	8 352	350·0	302	5,976·2	358·38
Keithdale Carnation ..	M. G. McArthur, Auckland	5 260	350·0	293	6,520·1	351·64

FRIESIANS.

<i>Junior Two-year-old.</i>						
Rosevale Echo Sylvia Colantha*	North and Sons, Omimi ..	2 144	254·9	305	20,309·2	732·56
Rosevale Queen Isobel Posch*	T. Sheriff, Clandeboye ..	2 140	255·0	365	21,792·2	701·30
Bywell Queen Alcartra*	T. H. Richards, Cardiff ..	1 339	240·5	365	14,279·2	587·98
Rosevale de Kol Plus Sylvia*	North and Sons, Omimi ..	2 170	257·5	365	18,680·0	538·16
Livingstone Lady Waka-loma	W. J. Eames, Hunterville ..	2 129	253·4	305	13,944·0	535·43
Dominion Pride of Domino	Central Development Farm, Weraroa	2 43	244·8	365	12,840·9	458·33
Dominion Ina Woodcrest	Central Development Farm, Weraroa	2 133	253·8	365	12,373·5	398·40
Glenmore Netherland Rose	D. H. Johnson, Stratford ..	1 314	240·5	364	7,718·7	337·86
Fendalton Nellie Posch 2nd*	J. I. Royds, Christchurch ..	2 7	241·2	257	8,889·7	245·53
<i>Senior Two-year-old.</i>						
Rosevale Sylvia May Echo*	North and Sons, Omimi ..	2 224	262·9	365	17,862·8	583·93
Pareora Cadillac Snow*	A. S. Elworthy, Timaru ..	2 340	274·5	365	14,181·0	522·14
Dominion Spot Beets	Central Development Farm, Weraroa	2 259	266·4	365	13,913·9	469·08
Willowburn Queen Mentor*	C. H. Potter, Pukerau ..	2 218	262·3	253	10,136·0	403·59
Bainfield Princess Pietertje*	McDonald and Co., Dunedin	2 242	264·7	365	10,903·9	398·23
Dominion Mary Fobes	Central Development Farm, Weraroa	2 356	276·1	365	10,388·2	338·09

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

FRIESIANS—<i>continued.</i>						
<i>Junior Three-year-old.</i> Bainfield Sylvia Delhurst 5th*	W. Robertson, Middlemarch	3 11	278·1	353	16,025·5	682·95
<i>Senior Three-year-old.</i> Woodlands Pontiac May 6th*	Smart and Son, Tikorangi	3 210	298·0	172	8,087·0	318·50
<i>Senior Four-year old.</i> Highland Princess* ..	C. J. Schumacher, Ngaere	4 348	348·3	339	13,670·1	538·99
<i>Mature.</i> Monavale Queen Bess*	T. H. Richards, Cardift ..	7 363	350·0	365	26,461·8	1002·20
Rose of Ngaere* ..	C. J. Schumacher, Ngaere ..	6 214	350·0	305	20,504·4	794·26
Cluny Pietje Lulu* ..	Piri Land Co., Auckland ..	6 13	350·0	305	17,479·3	656·77
MILKING SHORTHORNS.						
<i>Senior Three-year-old.</i> Pine Farm Jewel 4th A	Estate of John Fisher, Puke-rimu	3 296	306·6	365	10,555·8	452·82
<i>Junior Four-year-old.</i> Matangi Matilda 4th*	Hon. Mrs. E. J. Blyth, Kohi-marama	4 0	313·5	358	14,640·2	630·38
<i>Mature.</i> Braeside Sweet Nell 2nd*	Hon. Mrs. E. J. Blyth, Kohi-marama	6 293	350·0	365	16,981·6	851·21
Pukekite Duchess* ..	Hon. Mrs. E. J. Blyth, Kohi-marama	5 294	350·0	332	11,194·5	485·57
Braeside Lucy* ..	Hon. Mrs. E. J. Blyth, Kohi-marama	8 258	350·0	348	11,546·9	481·61
AYRSHIRES.						
<i>Two-year-old.</i> Braeside Barbara† ..	W. F. Olson, Egmont Village	2 33	243·8	365	12,855·0	552·79
<i>Three-year-old.</i> Maesgwyn Ivy ..	C. M. Williams, Kaiapoi ..	3 266	303·6	365	12,426·4	519·64
<i>Four-year-old.</i> Maesgwyn Mignonette	C. M. Williams, Kaiapoi ..	4 77	321·2	318	11,645·5	456·60
Edendale Jewel ..	W. Hall, Lepperton ..	4 245	338·0	338	9,684·3	394·91
<i>Mature.</i> Maesgwyn Miro ..	C. M. Williams, Kaiapoi ..	6 4	350·0	365	14,233·4	563·63
Keitha of Edendale ..	W. Hall, Lepperton ..	7 35	350·0	296	9,457·6	353·11
RED POLLS.						
<i>Two-year-old.</i> Neutyle Sunbeam* ..	G. S. Young, West Plains ..	2 79	248·4	365	10,479·0	345·24
Dominion Cigar ..	Central Development Farm, Weraroa	2 27	243·2	365	6,332·9	337·66
Dominion Zealand ..	Central Development Farm, Weraroa	2 319	272·4	339	6,967·1	317·01
<i>Four-year-old.</i> Wayward 6th B No. 1*	G. S. Young, West Plains ..	4 297	343·2	365	13,290·0	580·05
<i>Mature.</i> Dominion Ruapehu	Central Development Farm, Weraroa	6 353	350·0	365	10,527·4	427·17

LIST OF RECORDS—continued.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
<i>Second-class Certificates.</i>						
Jerseys.						
<i>Junior Two-year-old.</i> Vernon Golden Rose	G. R. and H Hutchinson, Auckland	Yrs. dys.	lb.		lb.	lb.
		1 298	240·5	365	6,643	7,399·69
Friesians.						
<i>Junior Two-year-old.</i> Rosevale Sylvia Burkey* Rosevale Doreen Sylvia*	North and Sons, Omimi .. North and Sons, Omimi ..	2 146 2 20	255 1 242·5	365 12 365 15	8,337 15,030·1	475·19 463·43

IMPORTATION OF FERTILIZERS.

FOLLOWING are the importations of fertilizers into New Zealand for the six months ended 30th September, 1927:—*Sulphate of Ammonia* From United Kingdom, 521 tons; Australia, 525 tons; Germany, 3 tons. *Nitrate of Soda*. Chile, 620 tons. *Basic Slag*: United Kingdom, 5,069 tons, Belgium, 11,337 tons; France, 22 tons. *Bonedust*: India, 700 tons; Australia, 25 tons. *Chardust and Bone Char*: Australia, 101 tons. *Guano*: United Kingdom, 25 tons. *Phosphates*: New Caledonia, 1,902 tons; Seychelles Island, 3,678 tons; Walpole Island, 1,143 tons; Ocean Island, 22,620 tons, Nauru Island, 47,388 tons; Makatea Island, 7,599 tons; Australia, 4 tons; Egypt, 6,603 tons. *Superphosphate* United Kingdom, 100 tons; France, 120 tons. *Kainit* United Kingdom, 20 tons; Belgium, 50 tons, France, 167 tons, Germany, 142 tons. *Muriate of Potash*: France, 15 tons; Germany, 3 tons. *Sulphate of Potash*: United Kingdom, 10 tons, France, 297 tons, Germany, 371 tons. *Potash, other* France, 925 tons, Germany, 663 tons. *Sulphate of Iron*: United Kingdom, 5 tons; Australia, 17 tons, United States of America, 7 tons. *Other Fertilizers* United Kingdom, 1 ton, Germany, 7 tons, United States of America, 13 tons.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Journal* from 22nd September to 3rd November, 1927, include the following of agricultural interest. —

No. 56515: Device for cleaning dairy utensils, W. A. Tomlinson, Waitangi, Waikato. No. 56849: Manure-mixing machine; Automatic Mixers, Ltd., Dunedin. No. 57093: Fruit-sacking machine; O. A. Moe, Yakima, U.S.A. No. 57854: Stock-food; U.S. Farm Feed Corporation, New York. No. 58290: Manure-distributor; J. L. Cowern and N. W. Storey, Rangiatea. No. 57177: Hedge-cutting machine; R. A. Reston, Auckland. No. 57502: Twitch-working implement; F. T. McNulty, Chertsey. No. 58251: Milk-releaser, G. J. Heaven, Masterton. No. 59092: Fence-post; V. G. Symes, Culverden. No. 57252: Grubber; A. E. Hosking, Johnsonville. No. 57568: Cream-improvement process; M. O'Callaghan, Buenos Aires. No. 57749: Device for securing lids to fruit-cases; M. Davey, Blenheim. No. 57826: Threshing-mill; C. Collett and J. H. Collett, Invercargill. No. 59142: Sheep-shearing machine; J. Davidson, Sydney, N.S.W.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington, price 1s. All fees must be paid in advance in cash, or paid to the Public Account at a branch of the Bank of New Zealand and the bank receipt sent to the Patent Office, or fees may be remitted by Post Office order or postal note.

WEATHER RECORDS : OCTOBER, 1927.

THE Director of the Dominion Meteorological Office (Dr. E. Kidson) reports as follows :—

During October rainfall was, as a rule, poorly distributed in time and place, and the 14th and 23rd were the only days on which it was at all of a general character. The total for the month was considerably below normal over the whole of the North Island and in the Marlborough and Nelson Provinces in the South Island. Canterbury and Otago had a moderate excess, while in Westland the differences from normal were slight.

Pressure was chiefly of the westerly type, and the disturbances of slight to moderate intensity. The changes were generally too rapid to allow of rain developing to any extent. On the 23rd, however, a very intense cyclone developed east of the South Island, and on the 24th the Chatham Island barometer fell to 29.07 in. From the 23rd to 25th strong southerly winds to gales were experienced, and very cold temperatures prevailed in the rear of this cyclone. Light falls of snow occurred on the 23rd and 24th in various parts of the South Island, and also in the high central area of the North Island. Ground frosts were reported on the mornings of the 25th and 26th, more especially in Canterbury and Otago, but the damage to fruit-trees was fortunately only slight.

There was a tendency for anticyclones to move in more northern latitudes, but one, which controlled the weather between the 25th and the 29th, was centred over New Zealand on the 27th with pressure as high as 30.50 in.

On the whole, fair to fine weather predominated, with moderate to strong north-westerly winds. The cold spell from 23rd to 25th, however, was severe, especially in Canterbury and Otago, and some losses of lambs occurred. Though dry, the month was a good spring month. It was particularly favourable for sheep, but less so, owing to the dryness, for the dairy industry.

RAINFALL FOR OCTOBER, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
<i>North Island.</i>				
	Inches.		Inches.	Inches.
Kaitaia	1.84	6	0.68	4.48
Russell	3.58	7	2.01	4.06
Whangarei	3.62	7	1.35	4.64
Auckland	2.66	12	0.78	3.64
Hamilton	1.80	11	0.62	4.79
Kawhia	2.36	10	0.74	5.28
New Plymouth	2.96	11	0.53	5.48
Riversdale, Inglewood	5.60	11	1.52	10.37
Eltham	2.42	10	1.10	4.11
Whangamomona	3.83	10	1.04	9.11
Tairua	2.48	7	0.84	6.89
Tauranga	2.07	8	0.55	5.25
Maraehako Station, Opotiki	3.38	9	1.20	5.45
Gisborne	1.07	6	0.46	2.80
Taupo	1.49	5	0.44	4.28
Napier	0.47	5	0.40	2.30
Maraekakaho Station, Hastings	0.74	9	0.30	3.09
Taihape	2.49	7	0.71	3.99
Masterton	2.59	8	0.82	3.32
Pateta	3.15	9	1.35	4.11
Wanganui	1.20	1	1.20	3.67
Foxton	2.28	8	..	2.92
Wellington	1.92	8	0.67	4.19

RAINFALL FOR OCTOBER, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average October Rainfall.
<i>South Island</i>				
	Inches		Inches.	Inches.
Westport	5·83	21	1·17	6·97
Greymouth	9·04	22	1·52	10·03
Hokitika	12·64	23	2·21	11·84
Ross	14·01	18	3·65	15·16
Arthur's Pass	25·77	20	6·29	19·78
Okuru, Westland	14·46	19	1·94	15·37
Collingwood	3·02	5	1·72	11·03
Nelson	1·07	7	0·47	3·59
Spring Creek, Blenheim	0·68	5	0·40	2·72
Tophouse	3·45	13	0·98	5·90
Hanmer Springs	3·36	10	0·95	3·15
Highfield, Waiau	2·00	7	0·58	2·60
Gore Bay	2·68	6	1·10	2·25
Christchurch	2·75	9	1·03	1·68
Timaru	2·34	11	0·76	1·95
Lambrook Station, Fairlie	2·40	7	0·58	2·01
Benmore Station, Clearburn	1·82	9	0·92	2·09
Oamaru	2·36	12	0·62	1·68
Queenstown	2·79	13	1·12	3·48
Clyde	1·33	7	0·46	1·58
Dunedin	5·01	19	1·06	3·09
Wendon	3·32	13	0·74	2·50
Gore	3·92	20	0·78	3·37
Invercargill	4·09	24	0·56	4·44
Puysegur Point	12·05	23	1·62	8·16

TRIALS WITH WHITE ISLAND MINERAL DEPOSIT.

IN the September issue of the *Journal* a negative result was reported from the use of White Island mineral deposit on grassland at Waihou. It may be stated that the material used in this trial was not the standardized No. 1 Product now sold by White Island Products, Limited, the guaranteed sulphur content of which is 33 per cent. In the trials at present being carried out by the Department of Agriculture only the standardized products of the company are being used.—*T. H. Patterson, H.D.A., Instructor in Agriculture, Auckland.*

FOOT-AND-MOUTH DISEASE IN GREAT BRITAIN.

THE High Commissioner for New Zealand, London, has reported by cable the position of foot-and-mouth disease in Great Britain as follows: September—two outbreaks in Bedford and four in Glamorgan; October—eight outbreaks in Somerset, one in Wilts, and one in Middlesex: total, sixteen outbreaks for the two months.

Importation of Swine from Canada.—Regulations under the Stock Act governing the importation of swine from Canada were published in the *Gazette* of 10th November. A statement regarding this matter appeared on page 204 of the September *Journal*.

Books received.—The "New Zealand Flock Book," Vol 23, 1927; published by the Council of the New Zealand Sheep Breeders' Association, Christchurch. The "Pig Breeders' Annual, 1927-28"; published by the National Pig Breeders' Association, London.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

STOCK AND COPPER-SULPHATED WATER.

"INQUIRER," Havelock North :—

In the September number of the *Journal* in an article on "Braxy-like Disease of Sheep" there is mentioned among other preventive measures the use of copper sulphate. Would you kindly inform me if there is any danger of stock being poisoned by drinking from small springs and pools which have been treated in this manner?

The Live-stock Division :—

It is not likely that sheep, unless very thirsty, would touch water medicated recently with copper sulphate. When a stream or pool is dosed with copper sulphate the material dissolves readily, and would not remain long in a poisonous strength in the water. However, as there is a slight risk to the sheep, it is advisable to give the paddock a spell for about three days following the treatment. No mortality has been reported so far from farms where copper-sulphate dressing has been carried on extensively for some time past.

HEDGES FOR RECLAIMED MUD-FLATS

"MUD-FLAT," Opotiki :—

Could you tell me of any suitable hedge-plant to grow on reclaimed mud-flats, both as a stock-proof hedge and to be useful as a breakwind? Barberry does not appear to thrive on the wet clay at all.

The Horticulture Division :—

Reclaimed mud-flats of wet clay are rather extreme conditions for which to suggest suitable stock-proof shelter-belts. In the absence of barberry, which you say does not thrive there, there is little choice other than the Lombardy poplar or some species of willow. Planted close together, either of these would probably do well. They would be to a great extent stock-proof, and, when planted close, would not grow to a great height. On this class of land it is a very good system to make the large open drains, which are necessary at intervals, coincide with the boundaries of paddocks, and to plant the shelter-belt along the bank formed of the excavated soil from the drain, with a wire fence to protect it from stock, the drain itself protecting it on the other side. Under such conditions barberry, pines, or even probably Lawson's cypress would do very well.

* CONTROL OF WEEDS IN LUCERNE.

"LUCERNE," Enfield :—

In March, 1926, I drilled 20 acres with lucerne and got a splendid strike, but owing to the wet autumn the weeds also came well. Would it injure the lucerne-plants to cultivate the land (with fine tines) in November after feeding off or mowing; or would it be better to wait until next winter to do the work? The stand was not cultivated last winter.

The Fields Division :—

If the weeds referred to are fat-hen or yarr there will be little occasion for anxiety concerning the lucerne, as both these types will rapidly disappear after cutting or grazing. Lucerne-plants have extremely stout tap roots, and even when quite young stand fairly heavy cultivation. If by Christmas-time the lucerne does not appear to be overcoming the weeds, then we would advise a thorough cultivation. Summer cultivation after mowing is much more effective in ridding lucerne from grass and other weeds than winter cultivation. If grass is already growing in the lucerne, cultivation after the first cutting is advised

MILK-TESTING POINTS.

"OLD SUBSCRIBER," Whakarongo :—

Kindly oblige me with information on the following: (1) Can a Babcock testing-machine (six- or twelve-bottle size) be adapted to use Gerber glassware? (2) Can amyl alcohol be used to improve Babcock testing; if so, in what manner, and how much?

The Dairy Division :—

(1) A mechanic could probably alter a Babcock testing-machine so that Gerber butyrometers or test-bottles could be used in it. We would recommend that butyrometers of the "original" Gerber method be used. These bottles are about 7½ in. long over all. (2) The use of amyl alcohol is not necessary or advisable in connection with the Babcock method of testing milk or cream for content of fat.

STERILIZATION OF HONEYCOMBS.

L. D. CARTER, Napier :—

Would you kindly tell me if the method of sterilizing empty honeycombs with a solution of formalin and water (1 to 20) for forty-eight hours is approved and recommended by the Department of Agriculture in connection with the control of foul-brood?

The Horticulture Division :—

The sterilization of honeycombs with formalin solution is not generally recommended. If you have only a small number of combs on hand it will pay you better to destroy them. However, should you desire to try the formalin solution the following treatment may be given: Water (soft preferably) 4 quarts, liquid soap 2 oz., formalin 1 quart, immerse the combs for forty-eight hours, then thoroughly dry and air them for several days.

FEEDING OF HAY AND ENSILAGE.

E. W. McCARTER, Te Awamutu :—

I shall be glad to know whether ensilage can be fed to ewes in lamb without damage. Can you give the relative values of hay and ensilage for this purpose? Can you advise also as to whether ragwort if cut with hay retains its injurious properties when fed out with the hay?

The Live-stock Division :—

Ensilage can be fed to ewes in lamb without danger, provided it is not acid or mouldy. The relative value of hay to silage is 1 lb. hay equals ¾ lb silage, according to quality. Ragwort cut with hay retains its injurious properties.

SEMESAN FOR SEED-TREATMENT.

E. G. GANDY, Waipatiki :—

Page 12 of the *Journal* for July, 1927, describes a seed-treatment for dry-rot of swedes and turnips with a solution of Semesan. Can you tell me where I can procure this specific, and the approximate price?

The Fields Division :—

So far as we know, Semesan is not yet on sale in New Zealand. The manufacturers are the Du Pont de Nemours Co., Wilmington, Delaware, U.S.A., and the cost is about 2.75 dollars per pound. In Australia Semesan can be procured from R. F. Higgs and Co., 297 Castlereagh Street, Sydney, N.S.W., who are agents.

THE SEASON'S LAMBING: NORTH ISLAND ESTIMATE.

FROM information furnished by Inspectors of Stock in the various districts the average lambing for the current season in the North Island is estimated at 87.28 per cent. With 7,905,432 breeding-ewes in the North Island, as shown in the 1927 sheep returns, the number of lambs is estimated at 6,899,861. South Island and Dominion estimates will appear in next month's issue of the *Journal*.

ESTIMATED AREAS UNDER CEREALS AND POTATOES.

THE following estimates of the areas under wheat, oats, and barley in the Dominion for the current season were issued by the Government Statistician at date 8th November, the figures being based on a card census: Wheat—North Island, 4,400 acres; South Island, 265,600 acres: total, 270,000 acres. Oats—North Island, 27,000 acres; South Island, 285,000 acres: total, 312,000 acres. Barley—North Island, 3,000 acres; South Island, 18,500 acres: total, 21,500 acres. The corresponding final totals for the preceding season (1926-27) were 221,689 acres of wheat, 386,762 acres of oats, and 30,414 acres of barley. Wheat, therefore, has an estimated increase in area this season of 48,311 acres, oats a decrease of 74,762 acres, and barley a decrease of 8,914 acres. The areas under the different main varieties of wheat grown this season are specified as follows: Tuscan or Longberry, 182,158 acres; Hunter's, 34,163 acres; Velvet or Pearl, 11,319 acres.

Also from a card census and at date 8th November the Statistician estimates this season's area under potatoes as 5,100 acres in the North Island and 17,100 in the South Island, or a total of 22,200 acres. The corresponding final figures for the 1926-27 season were 5,942, 18,674, and 24,616 acres. Only holdings of 1 acre and over outside borough boundaries are covered by these figures; a fair aggregate area of potatoes is also grown on smaller holdings and within boroughs. Reckoned on the average of the last five seasons—5.34 tons per acre—the total yield from this season's area would be 118,500 tons, as compared with a total actual yield of 116,771 tons for 1926-27, in which the per-acre yield was below the average.

QUALITY OF BASIC SLAG.

IN his annual report for 1926-27 Mr. B. C. Aston, Chemist to the Department of Agriculture, remarks as follows on this subject:—

The quality of the basic slag imported into New Zealand has received attention during the year. It was not found that any low-grade slag was being offered, but in certain instances slag that was distributed direct to the consumer from the ship's side was found to be below the manufacturers' guaranteed analysis, and a suggestion by this Section that imported basic slag should be examined before shipment to New Zealand has been adopted. Arrangements have now been made whereby slag exported to New Zealand from British and Continental ports will be sampled and analysed in England by the chemists of the Imperial Institute. It will thus be possible to warn importers of any shipments that do not comply with the manufacturers' guarantee, and so allow of adjustments being made before the fertilizer is placed on the New Zealand market. The scheme, which is now in operation, has received the unanimous approval of importers, whose co-operation is necessary to ensure that all shipments are sampled.

Cider-making.—It is estimated that some 60,000 gallons of cider, valued at approximately £13,750, were produced in New Zealand during 1926-27—an increase of 10,000 gallons as compared with the previous year's figures. Up-to-date cider mills and presses are now being made in the Dominion.

Correction.—A misprint occurred in the bottom line of page 270 of last month's *Journal* in connection with egg-incubation temperatures. The temperature printed as 130° should have been 103°.

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WELLINGTON, 20th DECEMBER, 1927.

No. 6.

AGRICULTURAL LEGISLATION OF 1927.

F. S. POPE, Acting Director-General of Agriculture, Wellington.

A CONSIDERABLE number of Acts of Parliament affecting the pastoral, agricultural, and horticultural industries, and coming within the scope of the Department of Agriculture, were added to the law of New Zealand during the recent session. While there may not be complete unanimity as to the value of certain of the provisions of these new laws, the fact that they have been approved, either unanimously or by substantial majorities, by both Chambers of the Legislature, may be taken as conclusive evidence that they are likely to be of material benefit to the industries affected by them.

Any one who has been concerned in preparing even a single Bill and piloting it through Parliament will not need to be told that the task of placing the past session's agricultural legislation upon the statute-book has involved a large amount of initiative, careful thought, patient discussion, and sound judgment on the part of the responsible Minister and his officers. Every one, therefore, who is either directly or indirectly interested in the industries mentioned (and who in New Zealand is not?) owes a debt of gratitude to the Hon. O. J. Hawken, Minister of Agriculture, for having supervised the preparation of this large amount of valuable legislation and brought it safely past the rocks and shoals of keen parliamentary criticism to the desired haven.

The names of the Acts referred to are as follows: Massey Agricultural College Act, 1927; Canterbury College and Canterbury Agricultural College Amendment Act, 1927; Howard Estate Amendment Act, 1927; Institute of Horticulture Act, 1927; Fertilizers Act, 1927; Noxious Weeds Amendment Act, 1927; Seeds-importation Act, 1927; Orchard-tax Act, 1927; Fungicides and Insecticides Act, 1927; Introduction of Plants Act, 1927; Finance Act, 1927 (No. 2), (section 38); Stock Amendment Act, 1927; Slaughtering and Inspection Amendment Act, 1927; and Apiaries Act, 1927.

Of these, the first four deal with agricultural education; the next three mainly affect field-cropping and pastures; the next four relate principally to horticulture; and the last three concern live-stock, public abattoirs, and bees respectively. Let us look at them seriatim.

on the understanding that only the main points will be noticed, and that any one desiring the full particulars should consult the complete Acts, any of which can be obtained at slight cost from the Government Printer.

MASSEY AGRICULTURAL COLLEGE ACT, 1927.

The institution that is in future to be known as the Massey Agricultural College was given legal sanction by the New Zealand Agricultural College Act, 1926, which may therefore be referred to as the principal Act in this connection. The purpose of the Act of 1927 was to amend and amplify the principal Act. The main changes are as follows: The principal Act may in future be cited as the Massey Agricultural College Act, 1926, and the College itself is to be known as the Massey Agricultural College, instead of by its original name. For University purposes attendance at the Massey Agricultural College is deemed to be equivalent to attendance at Auckland University College or Victoria University College. This will enable degrees in agricultural science to be obtained through the Massey Agricultural College. The Council of the new College is given power to issue diplomas in agricultural science. Authority is given for the expenditure on the latter College of moneys under the Education Purposes Loans Act, 1919, not only for the purposes of that Act, but also for the purchase of live-stock, implements, or material. In general the Minister of Agriculture, instead of the Minister of Education, is made the connecting-link between the Government and the College.

CANTERBURY COLLEGE AND CANTERBURY AGRICULTURAL COLLEGE AMENDMENT ACT, 1927.

The existing legal sanction for the Canterbury Agricultural College (generally known as Lincoln College) is found in the Canterbury College and Canterbury Agricultural College Act, 1896, and in the amendments thereto. Last session's Act makes the following further amendments: For University purposes attendance at the Canterbury Agricultural College is deemed to be equivalent to attendance at Canterbury University College. This will enable degrees in agricultural science to be obtained through the Canterbury Agricultural College. The Council of the Agricultural College is given power to issue diplomas in agricultural science. The Council is increased by three members—from seven to ten—of whom two (instead of one) are to represent the Government, and two the Board of Governors of Canterbury University College. Provision is made for a Government subsidy on voluntary contributions to the funds of the Agricultural College. Authority is given for a Government grant not exceeding £10,000 to be applied, in accordance with the approval of the Minister of Agriculture, towards the erection, alteration, and equipment of the College buildings. Authority is also given for an annual grant, if voted by Parliament, of £3,700 for such research as is approved by the Minister of Agriculture after consulting the Council of Scientific and Industrial Research. In general the Minister of Agriculture, instead of the Minister of Education, is made the connecting-link between the Government and the College.

HOWARD ESTATE AMENDMENT ACT, 1927.

It will be remembered that the late Josiah Howard bequeathed his Smedley Station in Hawke's Bay to His Majesty the King without any restriction, but in confidence that the Government of New Zealand would use the property as a foundation or endowment for the purposes of agricultural education. To give effect to the testator's wishes the Howard Estate Act, 1919, was passed. It provided that the Public Trustee should hold the estate in trust as a permanent endowment for the purposes of agricultural education, the revenue to be used for (a) the establishment and maintenance of a school or institute of agricultural education, under the control of the Minister of Agriculture, and to be known as the Howard Agricultural Institute; and (b) the improvement and development of the estate. Minor amendments in this principal Act were made by the Howard Estate Amendment Act, 1926. Further amendments as follows were made by the Act of last session: (1) A Board—to be known as the Howard Estate Advisory Board—is constituted of representatives of the local authorities of the Hawke's Bay Provincial District to advise the Minister of Agriculture and the Public Trustee in regard to the management of the estate and the utilization of the revenue therefrom, and (2) it is provided that, in addition to the purposes mentioned under (a) and (b) above, the revenue from the estate may be used for the assistance and development of agricultural research or public agricultural education in New Zealand in a manner likely to be of special, but not necessarily exclusive, benefit to farming in the Provincial District of Hawke's Bay. This latter provision will enable such research and education to be carried on, if thought desirable, elsewhere than at the Howard Agricultural Institute when the latter is established. As soon as the necessary regulations as to its election can be prepared and gazetted, the Advisory Board will begin to function, and doubtless the utilization of the fund for the purposes for which it was created will commence without unnecessary delay thereafter.

INSTITUTE OF HORTICULTURE ACT, 1927.

The Institute is an incorporated body of persons interested in the advancement of horticulture in New Zealand, and includes horticulturists, scientists, public men, and private citizens in all parts of the Dominion. A number of other bodies whose objects bear upon horticulture are affiliated to the Institute. The latter is desirous of issuing authoritative certificates and diplomas to qualified horticulturists, with the dual object of (1) encouraging gardeners and others earning their living by doing horticultural work to undertake further study in order to obtain the Institute's certificate or diploma, and (2) giving persons proposing to employ gardeners or other horticultural workers a means of knowing whether applicants are properly qualified. The Act of last session authorizes the Institute to conduct examinations under a scheme to be approved by the Government, and to grant certificates and diplomas upon the results of such examinations. There is also provision for the issue, during a limited period, of diplomas without examination to horticulturists of not less than forty years of age and not less than twenty years' experience, and also provision for issuing

certificates or diplomas to persons arriving from abroad with proof that they have already passed equivalent examinations. The Institute is now preparing its scheme of examinations for submission to the Government for approval, and as soon as this is given the way will be clear for the Institute to make known to intending students the syllabus and conditions of the examinations to be passed before its certificate or diploma can be obtained. This should result within a comparatively few years in placing the horticulture of New Zealand upon a distinctly higher level.

FERTILIZERS ACT, 1927.

This Act, which comes into force on 1st June next, gives more complete control over the sale of artificial manures than that provided by the Fertilizers Act, 1908, which it repeals. The main changes in the law as it stood under the old Act are as follows:—

(a) Vendors must disclose the percentage and nature of any "filler" or "diluent" included in a fertilizer. Filler or diluent is defined as any substance not containing in appreciable amount nitrogen, phosphoric acid, or potash, which is incorporated mechanically and not by any chemical process as a component of any fertilizer.

(b) Vendors must also disclose the form in which the fertilizing ingredients contained in the fertilizer occur; for instance, in the case of phosphoric acid insoluble in water the vendor must state whether the phosphoric acid is included as basic slag, phosphate rock, bonedust, or as the case may be.

(c) A vendor may at his option disclose the percentage of phosphoric acid insoluble in water but soluble in a solution of citric acid of prescribed strength.

(d) Whenever so prescribed by regulations the fineness of grinding of the fertilizer or of any of its components must be stated.

(e) The registration of brands with the Department of Agriculture in the case of vendors who are not manufacturers or importers is considerably simplified, the vendor having merely to state the name and brand of the fertilizer and by whom it is registered.

(f) Provision is made for the sale of fertilizers in bulk—*i.e.*, unbagged—subject to suitable restrictions.

(g) The existing provision that all fertilizers must be put into branded bags as soon as manufactured is done away with.

(h) The provision that a fertilizer containing any imported ingredient must be contained in bags branded "Imported" has been dropped.

(i) The use of chemical contractions instead of words in full in the invoice certificates supplied to purchasers is prohibited.

(j) The period during which a purchaser may notify an Inspector that an official sample of any fertilizer is required to be taken has been extended to twenty days after delivery.

(k) Provision is made for prescribing by regulation definite limits of error that may be permitted in stating percentages of fertilizing ingredients.

(l) The form of invoice certificate to be issued to buyers is made more complete, and should ensure that a buyer with a fair knowledge of the subject will be able to obtain a clear idea of what he is buying.

(m) The sale—under the designation of “fertilizer”—of any material in respect of which a brand could not be registered under the Act is prohibited.

(n) Where fertilizer is imported or purchased for distribution by any organization—*e.g.*, a dairy company—to its members, without a sale taking place, the distributor must give to the Department and to each recipient of the fertilizer the same particulars as would have been shown in the invoice certificate had the transaction been a sale.

The regulations needed to give full effect to the Act are now being prepared, and will be gazetted as soon as practicable. [Further information regarding this Act will be found in a special article published elsewhere in this issue. —ED.]

NOXIOUS WEEDS AMENDMENT ACT, 1927.

The law in regard to noxious weeds is contained in the Noxious Weeds Act, 1908, and in the amendments thereto made in 1910, 1921, and 1923. The Act of last session makes the following changes in that law: (a) It relieves occupiers of land of their liability to prosecution without notice for failing to clear weeds; (b) it enables notice to clear such weeds as are growing in small patches to be given by general notification in the newspapers at suitable times without awaiting the flowering of the weeds; (c) it enables individual notices to clear weeds that are growing otherwise than in small patches to be given at suitable times without awaiting the flowering of the weeds; (d) it gives authority for an occupier who fails to clear weeds to be prosecuted twice, instead of only once, in each season, and fixes the minimum fine in the case of such second prosecution at £5; (e) it places the onus of clearing weeds, after individual notice or public notification has been given, not only upon the person in occupation of the land, but also upon the owner or any other person in receipt of the rents and profits of the land, and upon the agent or trustee of the occupier; and (f) it relieves the Department of Agriculture of the control of weeds in urban areas, and gives the urban authorities power to exercise such control if they so desire.

It is expected that these changes will enable the Department of Agriculture to gradually obtain better control of the weeds nuisance without inflicting undue hardship upon landholders.

SEEDS-IMPORTATION ACT, 1927.

Two objects are aimed at by this Act: first, to prevent certain kinds of imported seeds being sold as locally grown seeds, and, second, to prevent imported seeds of the same kinds being subsequently exported as New Zealand seeds. The kinds of seeds named in the Act are those of cocksfoot, lucerne, and white clover, but power is given to the Governor-General in Council to add other kinds to this list if it is found desirable to do so at any future time. The Act provides that before any seeds included in the list are imported into the Dominion in parcels exceeding 28 lb. in weight they shall have been so treated as to render them distinguishable from seeds not so treated, and authority is given for the making of regulations prescribing the treatment to be adopted for this purpose.

These regulations will be made as soon as practicable, and well before the Act takes effect on 1st April next. They will probably provide that 1 per cent. of the seeds shall be stained red. This treatment is both cheap and effective, and it does not prevent the germination of even those seeds that are actually stained, and has no effect whatever upon the 99 per cent. of unstained seeds. It may be thought that the staining of only one seed in a hundred would not be very noticeable, but in fact the red seeds stand out clearly, and make it quite impracticable to substitute, whether by accident or design, treated lines for untreated without detection being quite easy, or even to mix treated lines with untreated without discovery being almost certain.

It is hoped that the operation of this Act will result in an increased demand for our own seeds in the local market, and in the further development of the overseas trade in New-Zealand-grown seeds.

(To be concluded.)

GOVERNMENT CERTIFICATION OF SEED POTATOES.

PROGRESS OF THE SYSTEM IN CANTERBURY.

J. W. HADFIELD, H.D.A., Instructor in Agriculture, Christchurch.

THERE has been a very satisfactory response by Canterbury farmers in connection with seed-potato certification under the system described in the *Journal* for August last. Eighty-one growers have registered, many of them sending in more than one variety, and altogether 138 eligible lines have been received and planted at the Ashburton Experimental Farm.

Growers were requested to send in 100 sets of each line, and great care has been taken to plant these under the most uniform conditions. Grouping of the varieties under these conditions will afford very interesting comparisons, more especially in regard to vitality, and it will be possible to obtain a general survey and some idea of the standards to adopt before actual field inspection commences. These plots are open to inspection by any one interested, and it is hoped to arrange for a field-day early in January, when growers, merchants, and seedsmen will be invited to attend.

In addition to the certification trials, over 100 varieties of potatoes are being grown at Ashburton Experimental Farm. These have been collected from all parts of New Zealand, and are being used primarily with the object of preparing accurate descriptions of all standard varieties, also to clear up some of the confusion existing in regard to nomenclature. A start is also being made in the production of pure and healthy lines of our commercial varieties, and about 250 are growing on trial.

The accompanying table gives a general idea of (1) the distribution of registered growers in Canterbury, (2) the distribution of registered varieties in Canterbury, and (3) the number of lines of each variety received.

Distribution of Registered Potato Varieties and Growers in Canterbury, Season 1927-28.

Variety.	Waitaki to Pareora.	Pareora to Rangitata.	Rangitata to Rakaia.	Rakaia to Waimakariri.	North of Waimakariri.	Lines of each Variety.
Dakota	0	3	11	14	0	28
Arran Chief	4	5	2	10	2	23
Aucklander Short-top	0	0	0	4	12	16
Epicure	1	2	1	7	3	14
Up-to-date	1	0	1	8	1	11
Bresee's Prolific	0	0	1	8	0	9
Aucklander Tall-top	0	1	1	0	0	8
Magnum Bonum	0	0	0	5	0	5
Robin Adair	0	2	0	2	0	4
Aucklander (unspecified)	0	2	0	1	0	3
Pink Beauty of Hebron	0	0	1	2	0	3
Sutton's Supreme	0	2	0	1	0	3
Endurance	0	0	1	2	0	3
Early Puritan	0	2	0	0	0	2
Early Rose	0	0	0	1	0	1
White Beauty of Hebron	0	0	1	0	0	1
Early Regent	0	0	0	0	1	1
British Queen	0	0	0	0	1	1
Northern Star	0	0	1	0	0	1
Gamekeeper	0	0	1	0	0	1
King Edward	0	0	0	0	0	0
Totals	6	19	22	65	26	138

It will be seen that Dakota heads the list, and it is evident that there is a definite move on the part of growers to reinstate the popularity of this variety by the production of pure strains. It is most extensively grown between the Rangitata and Rakaia Rivers, and to a lesser extent between the Rakaia and Waimakariri. Aucklander is confined almost entirely to the area north of the Waimakariri, where it is extremely popular. Arran Chief is fairly uniformly distributed over Canterbury, and is extensively grown on the heavier potato-land of South Canterbury. Up-to-date and Bresee's Prolific have been sent in almost entirely from the area between the Rakaia and Waimakariri. This localization of varieties illustrates to some extent the effect of one or two enthusiastic growers specializing in the production of high-class pure seed. Other growers in the vicinity, realizing its value, procure their requirements from this source, and there springs up in that area a group of farmers raising high-class seed of one or two particular varieties.

It is to be regretted that the St. Andrews-Willowbridge-Waimate area is not better represented. This is partly accounted for by the fact that certain varieties—for example, Majestic, New Era, Perfection, and Britain's Best, which are very popular in this district—were not considered to be of sufficient importance for inclusion in this year's scheme. Some, if not all, will be included in future years.

Certified growers are reminded that their crops will be inspected when in flower. The second field inspection will be made when the shaws are maturing, and the final tuber inspection when the seed has been graded.

THE WILD PIG NUISANCE.

POISONING TRIALS IN WELLINGTON LAND DISTRICT.

D. MUNRO, Principal Inspector, Live-stock Division, Auckland.

DURING the years immediately succeeding the War period wild pigs made their presence felt to a greater extent than previously, more particularly on North Island back-country farms adjacent to extensive bush areas and deteriorated holdings going back to scrub and fern. Doubtless this was largely due to the fact that during the War wild pigs, like the rabbits, enjoyed a period when their increase was more or less unrestricted, owing to the demand made on the man-power of the Dominion. From these areas the pigs came out in great numbers at certain times, more particularly in the early lambing season, when the berry-supplies give out in the bush. On a number of farms the loss of lambs from wild pigs was so heavy that the settlers concerned found it impossible to profitably continue the raising of lambs and were forced to rely entirely on dry sheep.

Without a first-hand knowledge or ocular demonstration it would be difficult to appreciate the extent of damage or loss suffered by settlers in pig-infested areas. The loss of grazing due to damage of pastures by rooting, damage to fences, &c., is very considerable. In certain districts the areas rooted up in a manner resembling rough hillside ploughing would in the aggregate represent hundreds of acres, and the losses became so pronounced that the matter was eventually brought prominently under notice of the Department of Agriculture. The Government recognized that some measure of relief was due to the settlers suffering from the nuisance, and it was decided to offer a bonus of 1s. per snout for wild pigs destroyed. The snouts were collected by reliable settlers in the several districts, who in turn handed them over to a representative of the State Forest Service, who made the final count and paid out the bonus.*

Notwithstanding the great number of pigs paid for, I believe it would be no exaggeration to say that not more than 70 per cent. of those killed came into account. Many pigs fatally wounded are lost in the bush, and for various reasons numbers of snouts collected are never presented for payment. On each occasion when the payment of the bonus was temporarily discontinued owing to the vote being exhausted thousands of snouts were held by settlers, pig-hunting sportsmen, and Maoris, and these were eventually thrown away or destroyed.

After payment of the bonus for two seasons it appeared that little or no impression was being made and that the pigs were as numerous as ever. It was then considered desirable to carry out experiments with poisons, in the hope of discovering a quicker or more wholesale method of destruction. Consequently, being stationed at the time in a district comprising considerable areas of pig-infested lands, the carrying-out of such experiments was entrusted to me.

* The numbers of snouts paid for in the Wellington forest-conservation region for the two years 1925-26 and 1926-27 were 17,227 and 23,282 respectively. In the Rotorua region 2,026 and 4,366 snouts were paid for during the same period.

Prior to this I had for many years had ample opportunity of observing the habits of wild pigs, and had noted that the latter differed in marked degree from the domesticated pig and the majority of wild animals in that they have no fixed place of abode but roam over great areas, influenced almost entirely by the available quantity and variety of their food-supplies. Having cleaned up the supply of fern-root in a certain locality they may not return again in any numbers for several months, as the fern does not readily recover. These irregular roaming habits therefore add to the difficulty of successful poisoning. If the homing instinct of deer or rabbits were more highly developed in wild pigs it might be possible to accustom them to certain foods to which poisons could be added later.

In certain places on the Wanganui River, about old Maori settlements, numbers of fruit-trees still grow, and the fruit which falls to the ground is readily eaten by more or less wild pigs. I therefore concluded that it would be no difficult matter to successfully poison wild pigs by treating apples, quinces, potatoes, or carrots with suitable poisons. It was disappointing to discover later, however, that the taste for such desserts developed by pigs which had come in closer contact with settlement had not been generally acquired by the less enlightened majority, and that anything new or foreign to their surroundings at once aroused their suspicions, after which they avoided the places where these baits were laid.

Information gathered from settlers in different localities relative to the feeding habits of wild pigs differs considerably, which is no doubt due to the reason just stated—that their tastes vary a good deal according to the locality in which they have been bred and the extent to which they have become familiar with settlement. It is fairly generally admitted that poisoned meat—carcasses of sheep, cattle, or horses—can be used with some degree of success, but the settlers almost without exception decline to use meat baits owing to the danger of poisoning valuable dogs. The owners of land on which I desired to carry out experiments requested that such baits should not be used. I therefore confined myself to materials which would not be dangerous to dogs—namely, apples, artichokes, carrots, potatoes, oats, barley, peas, and phosphorized pollard.

It is claimed by persons who have had experience of wild pigs in rabbit-infested country that they readily take the poisons laid for rabbits. It would hardly be disputed that phosphorized grain and pollard laid on rabbit-infested country does destroy large numbers of pigs, but I am very strongly of the opinion that this is brought about through their eating the dead rabbits, including the paunch and intestines which contain the fatal dose. Such, at least, has been my experience. An examination of the dead pigs will almost invariably show the stomach to contain quantities of rabbit-flesh. I should hesitate to say that in some places the pigs would not eat the grain or pollard direct, but it may be held as a rule that they become casualties through eating the rabbit carcasses.

The Poisoning Trials.

In November, 1926, I visited several farms situated on the Wanganui River, but in most cases it was found that the pigs had suddenly disappeared from the more open country and had moved well back into

the dense bush, where it is rather difficult to follow them with poisons. However, on one extensive property situated a few miles inland from the river a number of pigs were located, and there was a good deal of fresh rooting and well-defined pig-tracks. This place was well suited for experiments, there being several open grassy clearings in the bush, and here poisons were laid. The following notes give particulars:—

Clearing No. 1: Some half-grown pigs seen here, also a good deal of rooting and other fresh traces. Laid carrots, potatoes, and artichokes treated with strychnine— $\frac{1}{2}$ to $\frac{3}{4}$ grain let into each bait.

Clearing No. 2: A good many fresh tracks and plenty of fresh rooting. Laid phosphorized pollard as prepared for rabbits.

Clearing No. 3: Fresh rootings and several well-defined fresh pig-tracks. Laid potatoes, artichokes, and carrots into which plugs of phosphorized pollard (double strength) had been inserted.

Clearing No. 4: Plenty of fresh rootings and well-defined regular tracks. Laid potatoes, artichokes, apples, and carrots treated with arsenic— $\frac{1}{2}$ grain per bait.

All the clearings were visited the following afternoon, but none of the baits had been disturbed and no new rootings could be seen. The manager of this property undertook to watch results, and from reports received later it would appear that the pigs avoided the clearings mentioned after the poisons had been laid.

At Otumango, about twenty-five miles up-river from Pipiriki, on a vacated farm, pigs were found to be very numerous, and the property was very suitable for purposes of experiment. The whole of the cleared land, between 300 and 400 acres, was rooted up, and it was quite evident that large numbers of pigs were about. In a large basin fringed by standing bush thirty to forty full-grown pigs were seen grazing on the young grass. In order that they might not be disturbed we waited till they had finished feeding, when they retired into the bush. On closer observation it was found that a great number of pigs regularly frequented this basin.

We therefore proceeded to lay out in plots a variety of poisoned baits previously prepared, each variety being laid separately; in other places similar baits were laid to which no poison had been added, to act as a check against those treated. More poison was laid in similar manner at different parts of the farm, the total area poisoned being approximately 130 acres. The party then retired on to a high point overlooking most of the ground where the poisons had been laid. During the afternoon three pigs which had come out unobserved evidently found some of the baits, as we first noticed them racing back to the bush. About ten minutes later another three full-grown pigs came from the bush along a low ridge to a place where some poisoned apples had been laid. With my glasses I could see quite clearly the apples on a track. On reaching the apples the leading pig stopped, smelt one, stood for a few seconds, and then fled back to the bush followed by the others. Soon after this an old boar came from the bush by another track, travelling down towards the basin. He also came to an apple, which he smelt, and stood for a few seconds in silent meditation; then, shying past the bait, he ran down the basin to where a patch of artichokes had been laid. Here he became quite alarmed, shying about like a young colt, and eventually bolted across the valley, making for the bush in the

opposite direction from which he had appeared. Four half-grown pigs were then seen to approach from the bottom of the valley; they crossed a stream and commenced to graze below where a patch of phosphorized pollard (rabbit poison) had been laid. They gradually worked up the valley till the leading pig reached the poison, when he stopped and looked at it; the others, 10 or 12 yards away, immediately ran up and stood for a few seconds as if in consultation, then broke, bolting back across the stream, disappeared in the scrub, and were not seen again.

Six different lots of from three to six pigs were noticed coming from different points. Some came well down into the basin before they reached the poisons, but in every case as soon as they came on any of the baits they immediately took fright and raced back to cover. At dusk we returned to camp. During that night very heavy rain fell which should have removed any smell of our hands that might have attached to the baits handled.

The following afternoon we returned to the observation point, from where we soon observed a party of three pigs come from the bush. They grazed for a time, gradually working downhill till they reached the treated area. Here they came on some apples, carrots, and artichokes which had *not* been treated with poison. They at once took fright, behaving in a manner similar to that already described. The appearance of these things, new or foreign to their natural surroundings, evidently filled them with suspicion, and they at once made for cover. At another point an old sow with a litter of five suckers came on to a patch of artichokes and apples. She was less timid than the others, but after a few minutes she also became very uneasy, and, gathering her family, departed somewhat hurriedly for the bush.

We continued to observe results on six days after the poisons had been laid, but after the second day no pigs ventured on to the poisoned areas. All the plots were carefully examined; several baits were missing, but this I attributed to sheep dislodging them, when they would roll down the steep slopes. In any case our search failed to reveal any dead animals.

On our arrival at Otumango homestead it was noticed that a patch of potatoes, evidently left by the previous owners, had been rooted over by pigs, and that the tubers were left untouched, evidence that they had not acquired a taste for this class of food. I was later informed by settlers and Maoris that although pigs frequently rooted the potato patches they did not readily eat the tubers.

Our experiments completed at Otumango, other properties were visited, but it was found that the pigs had moved back into the bush. It was therefore decided to abandon further efforts till a later season, when the pigs would have returned to the more open country.

The investigation was again taken up during the winter months, and an effort made to poison the natural food-supplies—wild berries. This proved a failure also, for the reason that the season had produced an abnormal crop, the whole of the bush-lands being literally carpeted with berries, and it was extremely difficult to detect the places where the pigs were feeding. Further trials were also made with grain, peas, beans, and pollard poison treated with aniseed oil, but in every case the results were similar to those already described. Nature appears

to have developed in the pig in its wild state a suspicious caution which is totally absent in the domesticated breeds.

Experiments were also carried out in Kaitieke County, with results very similar to those obtained on the Wanganui River lands. Mr. G. Millar, Stock Inspector at Taumarunui, who conducted these trials, supplied the following particulars :—

Having selected for experimental poisoning a property situated near a belt of bush, we soon found a well-defined pig-track leading out of the bush on to the clearings. On this we laid five baits of horseflesh of about 2 oz. with cubes of pollard poison inserted in the middle. The baits were laid about 5 yards apart on the track; other baits were laid on tracks leading through or under fences, and others again on fresh rootings about 300 yards distant from the first.

The baits were not examined for three days, when it was found that those laid on the rootings had not been disturbed. There were no fresh pig-marks about. Further on we picked up the fresh tracks of a large pig leading to where other phosphorized meat baits had been laid, and it was quite noticeable that the pig had stopped at and examined the baits but passed on without touching them. The baits laid on tracks alongside the fences were also untouched. In another place, where five baits had been laid, one was missing, another was moved about 3 yards, and the remainder were untouched.

We proceeded to another locality where pigs are fairly numerous, and we had no difficulty in picking up well-defined, freshly used pig-tracks. Here we laid a dozen meat baits poisoned with strychnine at a distance of from 6 to 10 yards apart, each being marked by a turned sod near by. Sixty yards farther on more meat and pollard poison was laid. In another place several more baits were laid, both strychnine and phosphorus being used. Some 400 yards distant, in a gully, another patch of poison was laid.

Three days later, on examining the various plots, it was noticed that nine out of twelve meat baits (strychnined) and two out of twelve phosphorized-pollard baits were missing. In another place three out of twelve strychnine baits (meat) were missing. The rest of the meat and pollard baits were untouched. No dead pigs could be found. The country is rough, with very dense fern. In all, only two out of thirty-four phosphorized-pollard baits were missing, while out of sixteen strychnined meat baits laid twelve were missing. The owner of the property reported that some days later his dog found one of the missing meat baits some distance from where it had been laid.

The result of these trials appears to confirm what had already been noted in previous experiments. Small meat baits are liable to be carried away by birds or cats, and left where later a dog may pick them up. In using meat it would probably be safer to use a large joint that could be securely anchored, and later destroyed if not eaten.

Conclusion.

On the occasion of my last visit to pig-infested country on the Wanganui River, during the past spring, a very decided decrease in the number of pigs was noticeable. This was confirmed by reports from several settlers, who stated that there were no pigs about this season. Asked if they could state the reason why, it was at once suggested that the war waged on them in connection with the bonus was principally responsible. I am also inclined to the opinion that the payment of the bonus has produced very much better results than was formerly realized; further, that if the same pressure is maintained the wild pig nuisance will in a few years be reduced to a point when it will cease to be a menace as in recent years.

So far as our experiments have been carried, it would appear that the more direct method of destruction—by knife, gun, and dogs—is a surer means of dealing with the wild pig nuisance.

THE BLACKBERRY PEST.

CONTROL—*continued.*

E. F. NORTHCROFT, M.Sc., Biological Laboratory, Wellington.

(1) CHEMICAL INVESTIGATION.

METHOD OF ELIMINATING INEFFECTIVE COMPOUNDS.

PRIOR to the establishment of the field experimental station near Wairoa a considerable amount of work had been carried out at the Biological Laboratory, Wellington, in the testing of chemical compounds. The usual method of tip dipping was adopted, and by immersing the blackberry shoots in solutions of varying strengths a positive or negative effect could be obtained. In this way over ten thousand tests were made, representing a great many compounds and mixtures of compounds. As far as it was possible and practicable to do so, every known plant poison, either alone or in combination, was employed, irrespective of the cost factor. Following is a list of some of the most important :—

Hydrochloric acid.
Nitric acid
Acetic acid.
Carbolic acid (phenol)
Xylol.
Methylated spirits.
Turpentine.
Benzene.
Kerosene.

Formalin
Ammonia
Carbon bisulphide
Hydrogen sulphide.
Mercuric chloride
Cupric sulphate (bluestone).
Cupric chloride
Copper acetate
Lead nitrate

Arsenious oxide (As_2O_3), in combination with one or more of such compounds as potassium or sodium hydroxide, sodium bicarbonate, sodium carbonate, sodium chloride, and sodium nitrate

Arsenic oxide (As_2O_5) alone and in combination with sulphuric acid

Arsenic oxide in combination with inorganic acids

Zinc sulphate.

Magnesium sulphate.

Barium chloride.

Potassium hydroxide, potassium chloride, and potassium nitrate—alone and in combination with each other.

Sodium chloride, sodium carbonate, sodium hydroxide, and sodium nitrate—alone and in combination

A number of proprietary specifics.

Hydrochloric acid, &c., was used in proportions varying from 1 to 10 per cent.

From these compounds the most effective, or those which showed any signs of causing considerable withering or injury to the stem or leaves of the blackberry, were selected, and then carefully tested on a field scale at the experimental station.

Arsenic Compounds.

Regarding the compounds with arsenic as the principal element, the following were used :—

(1) Arsenic oxide, or arsenic pentoxide (As_2O_5), as it is more generally known: This poison is not formed directly from the element arsenic by combustion in oxygen, as is the case with phosphorus, but by means of the use of oxidizing agents on arsenious oxide. If arsenious

oxide (As_2O_3) is digested with nitric acid, arsenic acid ($2\text{H}_3\text{AsO}_4, \text{H}_2\text{O}$) is formed, from which the anhydride can readily be obtained. On the experimental plots arsenic oxide was used (a) alone in concentrations from 0.5 per cent. up to 10 per cent. ; (b) with sulphuric acid, using arsenic oxide and the acid in varying strengths from 1 per cent. up to 10 per cent. ; and (c) with hydrochloric acid. It was found that where the higher percentages of acid were used the damage was so rapid that the permanent effect was anything but good ; hence the later strengths were not carried as far as the 10 per cent., but varied according to the compound used, the strengths being determined by the early experiments.

(2) Arsenious oxide (As_2O_3) : This is one of the most important compounds of arsenic, being known in commerce as white arsenic, or simply arsenic. It is a very violent poison, 0.06 gramme being a dangerous dose and 0.125 to 0.25 gramme fatal. The repeated use of arsenic renders one immune to much larger doses ; amounts as great as 0.3 gramme can be consumed by arsenic workers in Styria. They hold that it acts as a cosmetic, and also improves the breathing in mountain-climbing. The antidote is freshly precipitated ferric hydroxide, or a teaspoonful of mustard with a tablespoonful of salt in a glass of warm water. Arsenious oxide is a very fine white powder, not easily wetted with water, in which it is very sparingly soluble ; at a temperature of 15°C . 100 grammes of water dissolves only about 1.65 grammes, and the solubility is only slightly greater with boiling water. If the oxide is boiled with sodium or potassium hydroxide, carbonate, or bicarbonate, the meta - arsenite of sodium or potassium is formed. For example, if required quantities of arsenious oxide and caustic soda are boiled, sodium meta-arsenite (NaAsO_2) and water are formed according to the equation $\text{As}_2\text{O}_3 + 4 \text{NaOH} = 4 \text{NaAsO}_2 + 2 \text{H}_2\text{O}$. Many people seem to think they have for a long time been using this sodium meta-arsenite as a spray under the name of arsenite of soda ; but the composition of that specific is anything but constant, and though it contains a certain amount of meta - arsenite of soda it is more correctly a solution of arsenious oxide in sodium hydroxide ; it is this which has been found to have an extremely caustic effect on the foliage and green parts of plants.

In the experiments very many strengths of arsenious oxide dissolved in various proportions of sodium hydroxide or sodium carbonate, and also in various mixtures of sodium hydroxide and sodium chloride, were used. Sodium meta-arsenite was used in proportions from 1 per cent. to 10 per cent. The arsenic solutions were as follows :—

- Arsenic pentoxide and potassium cyanide.
- Arsenic pentoxide and potassium nitrate.
- Arsenic pentoxide and sodium chloride.
- Arsenic pentoxide and hydrochloric acid.
- Arsenious oxide and sodium hydroxide.
- Arsenious oxide, sodium hydroxide, and chloride.
- Arsenious oxide, sodium hydroxide, and nitrate.
- Arsenious oxide and hydrochloric acid.
- Arsenious oxide and sodium chloride.
- Arsenious oxide, sodium hydroxide, and potassium cyanide.
- Arsenious oxide and sodium carbonate.
- Arsenious oxide, sodium carbonate, and sulphuric acid.
- Arsenious oxide, sodium chloride, and hydrochloric acid.
- Arsenious oxide, sodium carbonate, and sodium chloride.

No attempt can be made here to give the various proportions in which the compounds were used, but none was over 10 per cent. or under 0.5 per cent. After selection from the chemicals and groups of chemicals in the above list, the following were tried as sprays on a large scale, together with compounds in the form of a vapour or solid. These latter were not previously referred to, as they had not been tested in any way in the laboratory.

Solutions.

Arsenic oxide.	Sodium meta-arsenite.
Arsenic oxide and sulphuric acid.	Sodium hydroxide and sodium carbonate.
Arsenic oxide and hydrochloric acid.	Sodium hydroxide and sodium nitrate.
Arsenic oxide and sodium nitrate.	Hydrochloric acid.
Arsenious oxide, sodium hydroxide, and sodium nitrate.	Sulphuric acid.
Arsenious oxide and sodium hydroxide.	Nitric acid.
Arsenious oxide, sodium carbonate, and sodium chloride.	Sheep and cattle dips.
	Proprietary mixtures.

These, also some others not included in the list, were all tested in the field at concentrations of 5 per cent. and 2 per cent., so as to enable a quick and rough comparison, and thus make some selection before going on to investigate the effect of each combination at the various strengths.

Gases

Hydrogen sulphide.	Arsenious chloride.
Carbon bisulphide.	Chlorine.
Sulphur dioxide.	

Solids.

Sodium hydroxide	Ferrous sulphate
Sodium chloride	Potassium cyanide.
Lime.	Calcium cyanide.
Sodium carbonate.	Superphosphate
Sodium nitrate	Basic superphosphate.
Cupric sulphate.	Basic slag.
Cupric chloride.	Ephos basic phosphate.

The Experimental Station and Field Work.

As mentioned in the preceding article of this series, the experimental station, near Wairoa, comprises an area of 40 acres, covered for the most part with tall dense blackberry which had been left untreated for a number of years. The year previous to the establishment of the station the bushes had flowered and fruited freely.

Under the method of subdivision decided upon the plots were made as large as could be afforded with the comparatively limited area available. The hillside blackberry adjacent to the store-shed was reserved for spraying experiments; the blackberry on the flat or gently sloping land was marked off into plots of convenient size to test those chemicals used in the solid form; while poisonous vapours were tested at the top of the section, and, for the sake of safety, well away from the road, dull, still weather being chosen.

TESTS WITH GASEOUS POISONS.

The gases used were sulphuretted hydrogen, carbon bisulphide, sulphur dioxide, arsenious chloride, and chlorine. In the manipulation

of these very great care was necessary, especially with arsenious chloride, which is a deadly poison, and one could be guided only by sense of smell as to how long it was advisable to remain in the area when applying the vapour. As there were no proper facilities on the section for the careful testing and confining of these vapours they could only be used under the most restricted conditions. In each case they were used before sunrise, as the atmosphere was most steady at that time. Under the conditions the vapours were used all that can be said is that they were ineffective. On a small scale they could be tested in confined areas, where the results would necessarily be very much better than the field experiments showed. However, it would be quite impossible from most points of view (especially cost) to carry out such experiments economically on a large scale.

TESTS WITH SOLIDS.

As already stated, the chemicals and mixtures used in the solid form were all applied on land which was either flat or very gently sloping. The blackberry was cut as close to the ground as possible, and the solid then sprinkled on at the rate of $\frac{1}{2}$ lb. to each square yard. All solid chemicals were applied during the winter of 1925, which was an unusually wet one. By the spring all the plots had shown vigorous and healthy growth, and at no time since have any of the shoots looked at all sickly. At the rate of $\frac{1}{2}$ lb. of solid per square yard 1 acre of land would require approximately 1 ton of the solid; and if arsenic pentoxide, which costs 84s. per hundredweight in Melbourne, were used, the total cost of material alone would be £84.

SPRAYING TESTS.

The plots for spraying tests were made as far as possible square, each being from $\frac{1}{16}$ acre to $\frac{1}{10}$ acre in area. At first the plots were regularly marked off with a track of about 1 yard wide, cut so as to mark off each block more clearly; but it was soon found that too much time was lost in properly marking off plots and keeping them defined in this manner. Consequently plots of convenient size were measured, the shape and size depending more or less on the line taken by the bushes, as much use as possible being made of any natural or stock tracks, in order to avoid cutting through a bush and so leaving half in one plot and half in another, each sprayed with a different mixture.

Methods of Experiments, &c.

The experiments were carried out at first in series of four at each strength of each compound or mixture. Four sprayings with each specific were necessary, the plots being treated as follows:—

- (1) Sprayed on plots of standing blackberry.
- (2) Sprayed on a second plot of standing blackberry.
- (3) Sprayed on plot which had been cut and the blackberry removed so that the spray could reach the crowns and cut stems.
- (4) Sprayed on plot after the blackberry had been cut and burnt *in situ*.

Each plot received the same treatment—was sprayed the same day and under the same conditions, all plots of the same area receiving the same volume of liquid—the volume being determined by the amount

required to thoroughly spray the plot of cut blackberry. In actual practice more solution was required to spray the cut plots than to thoroughly spray the standing bushes.

In each case there were two plots of standing blackberry sprayed, the reason being that the subsequent treatment of these plots was different. One was burnt when the new shoots were beginning to develop, and the other was not burnt until the shoots had well developed. This gave four plots at the second spraying, with the growth of shoots showing some considerable variation. The condition in the plot of standing blackberry which was simply sprayed was much the same as in the two plots which were cut before spraying, but the plot of standing blackberry which was sprayed and subsequently burnt did not attain the same amount of growth, because it was at least a month behind the others.

On making observations in 1926 from a number of plots sprayed in 1925 it was found that there was no advantage to be gained by any preliminary treatment before the spraying was carried out. The cutting of an acre of average blackberry costs from £4 10s. to £6, and added to this would be the cost of removing the dried tops before any chemical could be applied, thus entailing a large expenditure. Hence the total cost of labour plus specific would be very high—in fact, much higher than most land could stand. In the one case there is the cost of cutting and clearing plus cost of specific and application of same, while in the other is the cost of specific and application of same plus cost of burning. The treatment in the latter case showed much better results, and in addition the total cost of treatment was much lower.

Fortunately, it was found that as regards efficiency of the spray the best method was to treat the standing bushes, then leave them as long as possible—the longer the better. The best results were obtained when the plots could be left until new shoots had made some good growth before the plot was fired. Too great a risk should not be taken, however, for it must be remembered that a bad fire is far worse than no fire at all, and for the sake of safety it is better to burn when shoots are small than to take the risk of a bad burn.

During the period from June, 1925, to March, 1927, in which the field-work was conducted by me, many plots were discarded, and many new compounds and concentrations of the ingredients of used compounds altered from time to time. Where similar or nearly similar substances were being used, such as the various forms of arsenic, an endeavour was made to treat in the one day all the plots with the concentration, at 1 per cent., for the purpose of getting the relative values of the different mixtures, as explained later.

The total number of plots treated on the experimental area is very considerable, though the number was never constant for any period. The greatest number under treatment at any one time was 110, and that was more than enough for one person to have to make observations on as well as treat from time to time. At present there are only forty-nine plots, and it will not be necessary to experiment further even with all of these.

Spraying-apparatus.

Several types of spray-pumps have been used, including atomizers, force-pumps, bucket pumps, syringes, and knapsack spray-pump such as the Eclair Vermorel and Hollands. My experience was that the Eclair

Vermorel lasted longer than others and did not go out of order nearly so easily, besides being the only really safe knapsack sprayer for an operator using specifics of a poisonous or corrosive nature. The nose-piece was found to be a disadvantage, however; by means of the pump a good pressure could be developed and maintained, but on account of the construction of the sprayer it was not capable of making the maximum use of the pressure and would throw the liquid only a short distance, the liquid leaving the exit as a hollow cone and not in the shape of a fan. The most efficient arrangement was an Eclair Vermorel knapsack spray-pump from which I had removed the nozzle and replaced it with an adjustable one, fan-shaped. This type of spray-pump proved more efficient and economical and a better time-saver than the atomizer type, which requires the maintenance of a definite pressure to force the liquid through and deliver it in the form of very fine particles. A series of comparative tests was made with the best atomizer (one specially imported for this work), and from the viewpoint of time required for manipulation and carrying out the spraying it could not compete with the Eclair Vermorel. With the atomizer it would take a man working alone just over ten hours to spray an acre of dense blackberry—this time being the average of a number of tests which were made. Using an Eclair Vermorel to which had been fitted a fan nose-piece a man working alone would require two and a half hours of actual spraying-time to treat a similarly dense area.

Spraying-compounds.

Numerous chemical compounds and combinations of such compounds applied in the form of a spray have been tested thoroughly in the field, but up to the present no chemicals have been found which can kill the blackberry-plant. The root in some instances can be killed to a short distance underground, or the crown may be destroyed; but the plant can very readily send forth new strong shoots from below (see *Journal* for June last, pages 383-385), and not until a compound is found that can penetrate and travel along to the vital tissues in the root can there be any hope of eradication by means of a chemical.

Many chemicals, including arsenic compounds and arsenic with other compounds, &c., have a certain amount of value for withering the foliage and thus facilitating good, clean burns. Among these may be specified the following:—

- Arsenic oxide.
- Arsenic oxide and sulphuric acid
- Arsenious oxide and sodium hydroxide.
- Arsenious oxide, sodium hydroxide, and sodium nitrate.
- Arsenious oxide, sodium hydroxide, and sodium chloride.
- Arsenious oxide, sodium carbonate, and sodium chloride.
- Sodium meta-arsenate .
- Sodium carbonate and sodium hydroxide.
- Sodium nitrate and sodium hydroxide, &c.

But so far none of these compounds, used in any strength which could be applied economically, has been of the slightest use in really eliminating blackberry. The great advantage to be derived from the use of chemicals is enabling the farmer to get good, clean burns, and by this method doing away with the necessity of cutting large areas. The cost of cutting blackberry is extremely high in the affected districts, and it is

frequently impossible to get men to undertake the work if there is employment of any other kind available.

In all the specifics which showed any signs of being effective the constituent compounds (when they consisted of more than one chemical) were used in all concentrations from 1 per cent. up to 10 per cent., the amount of solvent remaining constant. To take a simple example, sodium nitrate was used with sodium hydroxide in the following proportions :—

NaNO ₃	(1) NaOH	(2) NaOH	(3) NaOH	(4) NaOH	(5) NaOH	(6) NaOH	(7) NaOH
1	1	1.5	2	2.5	3	4	5
1.5	1.5	2	2.5	3	4	5	1
2	2	2.5	3	4	5	1	1.5
2.5	2.5	3	4	5	1	1.5	2
3	3	4	5	1	1.5	2	2.5
4	4	5	1	1.5	2	2.5	3
5	5	1	1.5	2	2.5	3	4

In the case of all specifics it was found that the higher percentages were no advantage when used as a spray, the best results being obtained from concentrations lower than 5 per cent. The reason probably is that with the higher concentrations the effect is too rapid, and with all it would seem that slower action is preferable. With strong solutions the burning is so rapid and complete that withering and drying set in immediately, and consequently if there is any chance of even a little of the poison getting into the vital stream and being carried down it is lost on account of the strong corrosive action and consequent rapid sealing. Where the action is much slower one finds the effects more extensive. The leaves first of all develop a few spots, frequently as long as twenty-four hours and sometimes two or three days after the application of the spray; then the spot gradually enlarges, till eventually the leaves attain a brownish appearance; but it is still some time before they commence to shrivel up and dry. It is more than likely that during this slow continuous withering process a small amount of the poison may be able to find its way into the downward current and so affect the more distant parts of the plant.

Though a fair number of proprietary specifics were thoroughly tested, none was found to compare at all favourably with other compounds referred to.

SPRAYS OF GREATEST EFFICIENCY.

Of all the sprays used there is no doubt that the most effective and those with the greatest lasting-powers—giving the plant the maximum shock—are (1) arsenic oxide (As_2O_3) or arsenic pentoxide, and (2) arsenious oxide (As_4O_6) (white arsenic) with sodium hydroxide (NaOH) (caustic soda). Both are deadly poisons, the pentoxide being easily soluble in cold water, whereas the trioxide or white arsenic is only very sparingly soluble in the same medium. In sodium hydroxide the arsenious oxide is easily soluble, and this has been frequently used as a spray for all kinds of weeds. The two compounds were used for blackberry in all sorts of proportions and in many different strengths, the most favoured one being 2 lb. arsenic, 3 lb. soda, and 10 gallons water.

As a weed-killer the so-called sodium arsenite has frequently been used on railway tracks, especially in America, and it is generally advocated

for weeds by agricultural stations in different parts of the world. The most frequent formula given is 1 lb. white arsenic to 2 lb. sodium carbonate and from 3 to 9 gallons water. This killed most weeds fairly effectively, though by some it is claimed that if pure arsenite of soda is used diluted with from 4 to 8 gallons of water a much better weed-killer is obtained.

It has generally been claimed that arsenic compounds ruin the soil, but in articles in the *Biochemical Journal* for 1913 and in *Centralblatt Bakteriologie Abteilung* for 1914, on the influence of arsenic upon the biological transformation of nitrogen in soil, nitrogen-fixing power, and bacterial activities in the soil, it has been shown that water-soluble arsenic may exist in as much as 82 parts in 1,000,000 without hindering ammonification and nitrification processes—lower concentrations acting as stimulants. To quote one passage: "The greatest stimulation was noticed when the concentration of water-soluble arsenic in the soil was 10 parts in 1,000,000. The bacterial activities of the soil were checked only with enormous quantities of arsenic. Small amounts stimulated soil bacteria and caused the liberation of the soluble plant-food materials, especially phosphorus." The effect of arsenic in the soil on many plants is to stimulate, and many plants have been found to contain quite considerable quantities of arsenic and still remain healthy.

On animals arsenic has a toxic effect. The use of arsenic constitutes a certain danger to stock, for farm animals, especially cattle, on account of the brackish sweet taste, are attracted to the sprayed plants, and in this way they may easily secure a fatal dose. The lethal dose has been estimated as follows: For a horse, 1.9 grammes; for a cow, 0.64 gramme; for a dog, 32-64 milligrams. It has been stated, further, that poisoning of cattle cannot occur through eating grass that has taken up arsenic from the soil through the roots. It has, however, been shown by Gorup-Bezanetz that if arsenious acid is mixed with earth and plants are grown in such earth they only absorb infinitesimal quantities of arsenic.

In the *Journal of the American Chemical Society*, 1908, Swain considers that plants do not absorb enough arsenic from the soil to poison animals. In the 25th Annual Report of the United States Department of Agriculture, 1908, Formad proved arsenic deposited on pasture grasses to be a great menace to animals. He found arsenic present in grass and hay in amounts varying from 0.02 and 0.1 milligram of arsenious acid per gramme of dry sample. Cattle, horses, and sheep feeding on this died in great numbers and showed all symptoms of arsenic poisoning. On analysis arsenic was found in all parts of the animal tissues. However, this should not be a very serious difficulty in the way of the use of arsenic compounds for spraying, because it is an easy matter to add some such repellant as potassium xanthate ($\text{SC-SK-OC}_2\text{H}_5$). This need only be added to the spraying-solution in quite small quantities, and it will, I am confident, most successfully keep stock well away from the sprayed bushes. Here it might be mentioned that it is quite often a good plan to add some substance which will remain in very fine suspension in the spraying-fluid, as this will dry on the leaves and so show clearly where the bushes have been sprayed, and in this way obviate the liability of unnecessary repetition. For instance, when

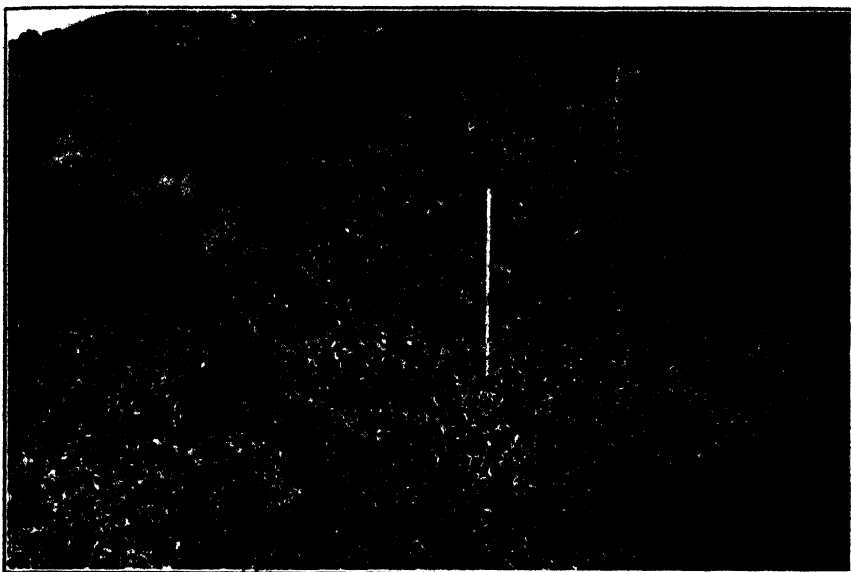


FIG. 22. BLACKBERRY-BUSHES ON ARSENIC AND SODA PLOT BEFORE SPRAYING.
The rule standing in centre is 6 ft long.

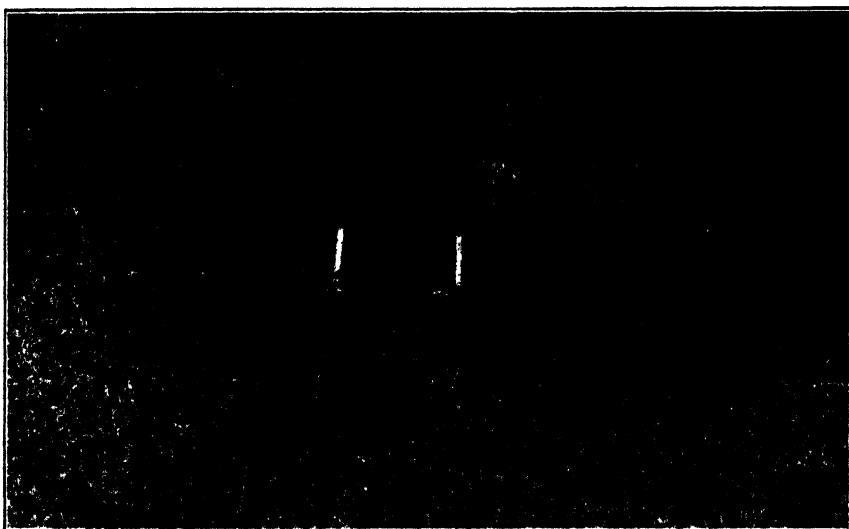


FIG. 23. THE SAME PLOT AFTER TREATMENT.
The vertical rule-arms are 6 in. long.

[Photos by the Writer.]

(See pages 380-382.)

spraying in situations near the sea it is easy to use sea-water in mixing the solution; when this dries a white deposit is left on the leaves, clearly marking the sprayed bushes from the others.

Experiments have been carried out to ascertain the rate of leaching of sodium arsenite from soils. Samples were taken from round a blackberry-bush which had been thoroughly treated with arsenite of soda. At first the percentage present was 0.68, but after a period of twelve months had elapsed analysis showed only 0.04 per cent. The method of mixing was as a rule as follows: The arsenic was mixed with a little of the water to a paste; then more water was added, and all brought to the boil. After boiling some time the container was removed from the fire and the soda was added. When all was dissolved it was diluted to the required strength. It was not until after the completion of a great number of laboratory and field tests that I was able to work out the most efficient and economical formula for the harder, more woody plants. This consists of 1 lb. of white arsenic to 1½ lb. of 98 per cent. fresh caustic soda. The great advantage gained with this is in the method of mixing, for artificial source of heat is not required—a fact of great advantage if the materials have to be mixed out in the field, where not only is it very difficult to make a fire, but also inconvenient and necessitating a considerable loss of time. This method is as follows: Mix the arsenious oxide and sodium hydroxide (which must be fresh—about 98 per cent.) dry; then add a little water—sufficient to make a paste—stirring thoroughly with a stick; as soon as it commences to bubble run in a little more water, but not sufficient to stop the bubbling; when bubbling has ceased the full quantity of water may be added. Care must be taken to stir thoroughly and also to keep well away from the fumes, which are of a very poisonous nature.

Later I altered my original formula to one containing 1 ton of white arsenic and 800 lb. of caustic soda. This formula was found entirely satisfactory, and quite the best arsenic-and-soda formula I have used. Murtons Ltd., of Napier, have now made this up in concentrated form in drums containing 5 gallons, at a price of 8s. per gallon of concentrated specific. This can be used in dilution with water at anything from 1 part in 90 to 1 part in 120. Since 150 gallons are required to spray an acre, the cost at the dilutions 1:100 and 1:120 per acre is 12s. and 10s. respectively, and the solution would contain about 1 per cent. of arsenious oxide. This is a considerable reduction in price when one considers that some of the best known specifics now on the market cost (even for some of the more moderate) £1 5s. per acre. There is only one other specific at all comparable with the foregoing, and that is arsenic pentoxide, which has been proved to be most efficient in 2 per cent. solution. The price of 1 cwt. in Australia is £4 4s., or 9d. per pound, making the cost of 150 gallons of a 2-per-cent. solution £2 2s. 3d.

If blackberry has to be cleared off a place, obviously spraying and burning is by far the most economical method to adopt. Cutting will cost from £4 10s. to £6 per acre, and a man can only cut 1 square chain per day. An acre of blackberry sprayed with arsenic-and-caustic-soda solutions would cost 12s. for the spray, and a man at



FIG. 24. ARSENIC PENTOXIDE PLOT BEFORE SPRAYING.
This bush was 8 ft. high.

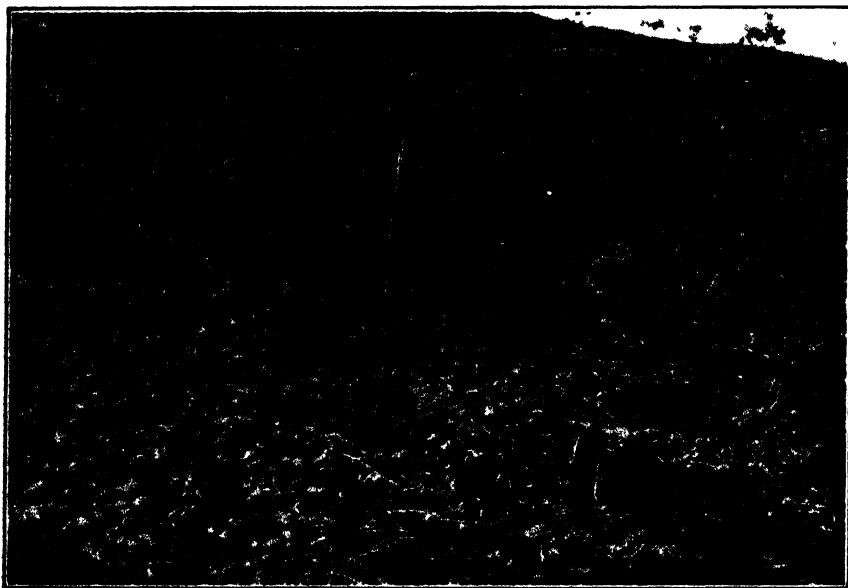
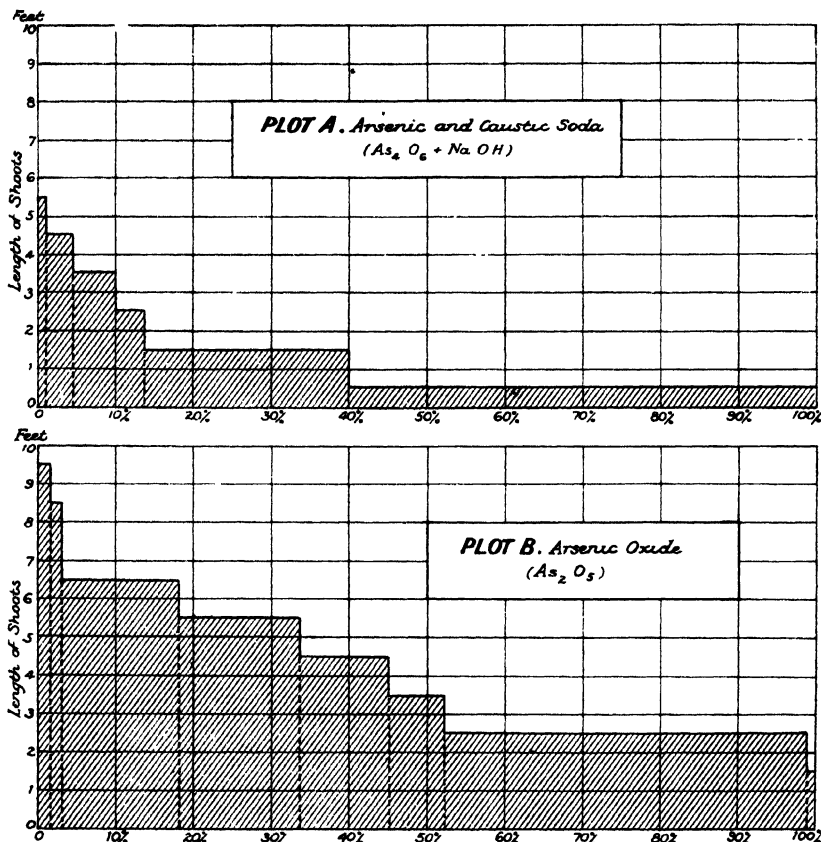


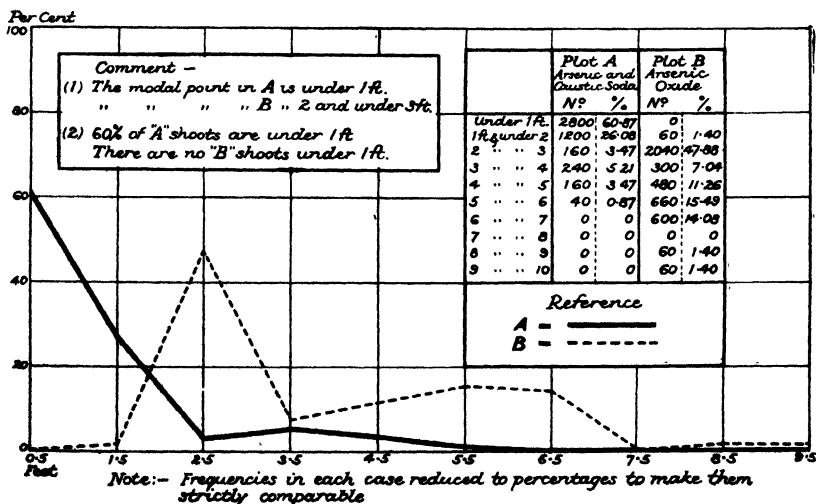
FIG. 25. THE SAME PLOT AFTER TREATMENT.
The rule in centre measures 3 ft.

[Photos by the Writer.]

(See pages 380-382)



GRAPHS 1a and 1b. SHOWING THE RELATIVE LENGTHS AND PROPORTIONS OF THE BLACKBERRY SHOOTS MEASURED ON PLOT A (NEW ARSENIC-CAUSTIC SODA FORMULA) AND PLOT B (ARSENIC PENTOXIDE) AFTER SPRAYING.



GRAPH 2. SHOWING FREQUENCIES IN PERCENTAGE OF LENGTHS OF BLACKBERRY SHOOTS ON PLOTS A AND B.

In March, 1926, plots were sprayed with the new formula, which I used diluted 1 part in 100 of water; and for the sake of comparison plots adjacent were sprayed with 2 per cent. arsenic oxide. They were all examined in March, 1927, and up to that time had had only the one treatment, whereas the plots referred to in Table 1 had had two sprayings up to the time of the analysis. Table 2 gives the details of these plots "A" and "B" respectively, and Graphs 1 and 2 afford a clearer idea of the situation. Fig. 22 shows plot "A" (arsenious oxide and caustic soda) before treatment in March, 1926, and Fig. 23 the same plot at the time of examination in March, 1927; the vertical arms of the rule seen in the latter figure are 6 in. long. Fig. 24 shows plot "B" (arsenic oxide) before treatment in March, 1926, and Fig. 25 the same plot in March, 1927, when examined, the rule in the centre being 3 ft. high.

(Series to be continued.)

TUBERCULOSIS IN CATTLE AND PIGS.

THE Director of the Live-stock Division (Mr. J. Lyons) refers to this subject in his annual report for 1926-27 as follows:—

An examination of the whole position as regards tuberculosis in animals in New Zealand indicates that the incidence of tubercular disease in cattle and pigs in New Zealand would appear to be decreasing, although there are still some districts possessing low, wet, and swampy areas where the disease is prevalent to a greater extent than elsewhere, and until better conditions can be brought about by means of drainage, &c., improvement will be difficult in these districts. The condemnations of cattle on clinical examination and as a result of the tuberculin test numbered 4,750, as against 4,692 last year. This constant weeding-out of clinically affected animals must be an important factor in controlling the disease and in gradually reducing its incidence. The Wellington inspection district (embracing all the North Island outside Auckland Province and including Nelson and Marlborough) shows a decrease of 198, and Canterbury-West Coast district shows a decrease of 66, compared with the previous year, while Auckland and Otago districts show increases of 280 and 42 respectively. The increase in the Auckland District can be traced as having taken place in low-lying swampy areas already referred to, and Otago's increase is attributable to reactions as a result of the tuberculin test, and is confined to a few herds. The number of cattle (excluding calves) examined at freezing-works and abattoirs on slaughter was 321,039, of which 16,333, or 5.08 per cent., were found to be affected in varying degrees, a considerable number only very slightly. These figures show a decrease of 0.08 per cent. on last year's returns, and, although small, it is nevertheless satisfactory, following as it does on the somewhat larger decrease which was shown for the preceding year. In the case of swine a decrease of 0.35 per cent is disclosed, which is also a satisfactory feature. The number of swine examined was 418,316, of which 34,405, or 8.22 per cent., were found to be affected in varying degrees, and, as in the case of cattle, a considerable number only very slightly.

Reputed Phosphate Rocks.—Several samples of reputed local phosphate deposits were submitted to the Chemistry Section of the Department during the last official year, but none was found to be of any commercial value. A reported discovery of highly phosphatic limestone in the Piopio district (King-country) was fully investigated, samples being taken by the Director of the Geological Survey and analysed in the Chemical Laboratory. The deposits proved to be remarkably pure limestone, containing less than 0.1 per cent. of phosphate, but 98 to 99 per cent. carbonate of lime.

THE NEW FERTILIZERS ACT.

ITS MAIN POINTS AND INCIDENCE.

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LEGISLATION to control the sale of fertilizers in New Zealand was first promoted in 1892, when the Manure Adulteration Act was passed. This measure was superseded by the Fertilizers Act, 1904, afterwards consolidated in the Fertilizers Act, 1908, which, among other things, provided for the registration of vendors and gave greater powers of control to the administering Department.

In response to a widespread demand from farmers for more information as to the nature and quality of the fertilizers they were using, and to bring our legislation into line with that of other British dominions, the Fertilizers Act, 1927, was prepared, and passed by Parliament during the recently ended session. The new Act not only affords greater protection to the users of fertilizers—who in the last year spent over a million pounds sterling in the purchase of fertilizer materials—but also provides certain improved conditions for manufacturers and vendors.

BENEFITS TO THE FARMER.

Under the Act of 1908 the vendor was required to give the purchaser of 5 cwt. or more of any fertilizer a certificate stating the percentages of the fertilizer ingredients—nitrogen (soluble and insoluble in water), phosphoric acid (soluble and insoluble), and potash. This information was in many cases of very limited value to the farmer. He was told, for example, that his fertilizer contained 3 per cent. of insoluble nitrogen and 12 per cent. of insoluble phosphoric acid. But he did not know whether the nitrogen was in a form such as dried blood, quickly available to the plant, or in that of the less readily available meat-works tankage, or even in a form of nitrogenous waste matter (*e.g.*, hair or leather) that would take a very long time to decompose in the soil and become of use to the crop. In the case of phosphoric acid he was not told whether it was supplied as basic superphosphate, or as slower-acting ground rock phosphate, or in some other form.

Under the new Act the purchaser will receive with each lot of 5 cwt. or more a certificate showing not only the percentages of the fertilizer ingredients, but the forms in which they occur and the proportion of each component in the mixture. He will also know the nature and amount of any "filler" used. Here it may be pointed out that a filler or diluent (*i.e.*, a substance containing no nitrogen, phosphoric acid, or potash, mechanically incorporated in a fertilizer mixture) is not necessarily, nor even usually, to be regarded as an adulterant. Such substances have legitimate uses in certain mixtures, such as in improving their mechanical state for drilling and in standardizing the composition of the fertilizer. In the case of certain fertilizers, such as basic slag and ground rock phosphate, in which the fineness of grinding is important, the fineness will be shown on the vendor's certificate. The regulations under the Act will prescribe standards of fineness required in such fertilizers.

The invoice certificate has the effect of a warranty by the seller to the purchaser that the particulars contained in it are true within any limits of error prescribed in the regulations.

An important feature of the Act is the restriction of the use of the term "fertilizer" to substances accepted for registration as fertilizers under the Act. Any person offering for sale as a fertilizer any substance not registered as such is liable to prosecution.

Any purchaser desiring an official analysis of a fertilizer supplied in packages may give notice within twenty days (previously ten days) to an Inspector, who will attend and take a sample on payment of the fee of two guineas. The vendor or his agent is entitled to be present at the taking of the sample, and in the event of the analysis proving the accuracy of the invoice certificate the vendor may claim from the purchaser his reasonable expenses incurred in attending.

A facility not provided in the Act, but which may again be mentioned here, is that the Department of Agriculture will make without charge an unofficial analysis of any sample of fertilizer bought by a farmer, if accompanied by the vendor's invoice certificate for comparison with the analysis. Such samples should be of 1 lb. to 2 lb. in weight, taken from several bags, and should be addressed to the Chemist, Department of Agriculture, Dominion Laboratory, Wellington. On completion of the analysis the purchaser will be advised whether the composition of the fertilizer is in accordance with the invoice certificate.

THE ACT IN RELATION TO MANUFACTURER AND IMPORTER.

The manufacturer or importer is required to register his name and address, and to apply for registration of the brand of each fertilizer he proposes to sell. The application must be renewed in the month of June in each year. He will deposit a full description of each fertilizer as outlined above, and will receive a certificate of registration with respect to each brand. Previously the manufacturer had no protection of his brand under the Act, provided that no fertilizer sold under the same brand differed materially in composition. The new Act gives this protection to the owner of a registered brand. Registration of a brand remains in force until the end of June next following.

Provision is made for the sale of fertilizers in bulk, and for the sale, without registration, of "special mixtures" (to be so branded) of fertilizers in proportions according to the written instructions of the purchaser. In the case of such special mixtures the invoice certificate may show the required particulars separately in respect to each constituent of the mixture.

The registered particulars of a fertilizer will no longer show the "minimum percentages" of the ingredients, but will state the actual percentages within the limits of error allowed in the regulations. The statement of chemical ingredients required in the vendor's statement and invoice certificate has been simplified. Unit values and "equivalents" in tricalcic phosphate and in sulphate of potash have been eliminated, and the term "phosphoric acid" has been substituted for "phosphoric anhydride." The terms "nitrogen," "phosphoric acid," and "potash" must be expressed in words and not in symbols.

The vendor may, at his option, state the "citric solubility" of such fertilizers as basic slag.

Vendors may keep stocks of fertilizers in bulk, but must keep a record of the registered brands of such fertilizers so that the brand of any bulk lot can be readily ascertained.

Special provision is made for fertilizers imported on behalf of consumers but not offered for sale or exchange in the ordinary way. In such a case the person or firm acting as agents for the consumer is not required to register as a vendor, but must, within fourteen days after receiving the fertilizer, forward to the Chemist of the Department of Agriculture a sample of the fertilizer, and forward to the Director-General a statement containing the particulars (other than brand and name) required to be deposited by a manufacturer or importer. On distributing the fertilizer the agent must supply each consumer with a statement containing the particulars required to be set out in an invoice certificate. Similarly, if such a buyer's agent purchases fertilizers in New Zealand on behalf of consumers, he is required to supply to each consumer a copy of the invoice certificate received by him.

OBLIGATIONS OF THE RETAILER.

The retailer or selling agent who does not manufacture, import, or mix fertilizers is no longer required to deposit with his registration full particulars of the ingredients of fertilizers. He will register his name and address, and will deposit a statement showing, in respect to each fertilizer offered for sale, the brand and name of the fertilizer, and the name and address of the person or firm by whom the brand has been registered. He will, of course, supply the purchaser with an invoice certificate showing the full particulars of the fertilizer.

It is provided that a vendor who may be convicted of an offence under the Act in selling fertilizer at variance with the invoice certificate may, in any action against the previous vendor for breach of warranty, recover the amount of the penalty and costs on proving that he purchased the fertilizer in good faith and sold it in the same condition as he received it.

REGULATIONS.

The regulations to be gazetted under the new Act will prescribe, among other things, the limits of error allowed in the manufacturer's statement and invoice certificate, the methods of sampling and of analysis, and the standards of fineness of grinding of certain fertilizers.

The new Act comes into force on 1st June, 1928; until then the provisions of the Fertilizers Act, 1908, remain effective.

Soda Flavour in Butter.—The so-called "soda flavour" in butter was investigated by the Chemistry Section of the Department during the past year. The results obtained led to the conclusion that the objectionable flavour was due in many cases to the use of high-acid cream, rather than to the over-neutralization of cream of a lower degree of acidity.

RAPE-MANURING EXPERIMENTS IN CANTERBURY, SEASON 1926-27.

A. W. HUDSON, B.Ag., B.Sc., Instructor in Agriculture, Christchurch.

IN pursuance of the policy of testing the manures used in its experiments over a period of years, trials similar to those made in the two preceding seasons were again carried out by the Department of Agriculture in 1926-27, on the farms of Mr. J. Symes, Darfield, and Messrs. R. and J. Gunn, Racecourse Hill. The investigation chiefly affecting the method of application of superphosphate was also repeated, with certain modifications, on the farm of Mr. W. W. Mulholland, Darfield. The experiments are again designated "A" (Symes), "B" (Gunn), and "C" (Mulholland). The preceding two years' results were recorded in the *Journal* for November, 1925, and October, 1926, respectively.

Experiments A and B.

The treatments used on these experiments were as follows:—

- (1) Superphosphate (44/46 per cent. tricalcic phosphate), 1 cwt. per acre.
- (2) Ephos phosphate, 1 cwt. per acre.
- (3) Super $\frac{1}{2}$ cwt. and Ephos $\frac{1}{2}$ cwt., 1 cwt. per acre.
- (4) Super 1 cwt. and dried blood 1 cwt., 2 cwt. per acre.
- (5) Superphosphate, 2 cwt. per acre.
- (6) Super 1 cwt. and Ephos 1 cwt., 2 cwt. per acre.

Six replications of the above were sown. The seed was sown in 7 in. rows (*i.e.*, through every coulter of the drill). Dates sown: Experiment A, 23rd November; experiment B, 10th November, 1926. Seeding for both experiments, $2\frac{1}{2}$ lb. per acre (the same as in the preceding year, which was recorded as 3 lb. by mistake). History of paddocks: Experiment A, 4 years in grass prior to trial; experiment B, 5 years in grass before test.

EFFECT OF MANURES ON GERMINATION.

Table I shows the number of plants occurring in one row 10 ft. in length. The germination under each treatment is compared with that on the 1 cwt. of super plots.

Comments on Table I.

All treatments in Experiment A have given more than twice the germination of the same treatments in Experiment B, although both areas were sown at the same rate per acre. The difference is due to the fact that Experiment B, sown on 10th November, experienced a severe thunderstorm two days later and further heavy rain in the following week, with the result that the surface of the ground became badly poached and the plants had difficulty in getting through. Experiment A, sown on 23rd November, met with ideal conditions. In both experiments the only treatments which show a significant depression in germination are the super-and-blood mixture and the super 2 cwt. In neither case is this anything approaching the bad effect of these treatments in the preceding season on Mr. Symes's

Table 1. —Effect of Manures on Germination in Experiments A and B.

Treatment per Acre	Experiment A. Counts taken 43 Days after Sowing.			Experiment B. Counts taken 42 Days after Sowing.		
	Number of Plants per 10 ft. (Mean of 78 Counts).	Difference from Super 1 cwt. Plots.	Difference, Significant (S.) or Non- significant (N.S.).	Number of Plants per 10 ft. (Mean of 66 Counts).	Difference from Super 1 cwt. Plots.	Difference, Significant (S.) or Non- significant (N.S.).
Super 1 cwt.	28.4	..		13.5	..	
Ephos 1 cwt.	27.2	-1.2	N.S.	13.6	+0.1	N.S.
Super $\frac{1}{2}$ cwt. and Ephos $\frac{1}{2}$ cwt.	29.3	+0.9	N.S.	12.8	-0.7	N.S.
Super 1 cwt. and blood 1 cwt.	26.7	-1.7	S.	12.0	-1.5	S.
Super 2 cwt.	25.0	-3.4	S.	11.7	-1.8	S.
Super 1 cwt. and Ephos 1 cwt.	27.9	-0.5	N.S.	13.2	-0.3	N.S.

NOTE.—A difference is regarded as "significant" where the chances are greater than 30 to 1 in its favour.

farm, where the blood mixture germinated only 54 per cent. and the super 2 cwt. 61 per cent. compared with super 1 cwt. as 100 per cent.

In the 1926-27 season there was always an ample supply of moisture during the early growing-period, and the plasmolysing (commonly called "burning") effect of the heavier dressing of super was much reduced. The fact that under conditions of ample moisture blood has not been so harmful on germination points to the fact that this substance, too, *may* cause plasmolysis, possibly by rapid bacterial conversion into nitrates.



FIG. 1. RAPE EXPERIMENT A (SYMES'S FARM).

From left: (1) N_0 manure; (2) super 1 cwt.; (3) Ephos 1 cwt. Photo taken on 26th January, 1927.

Observations during Growth.

Experiment A: On 5th January, forty-three days after sowing, the plots having the heavier dressing of super plus Ephos at 2 cwt., and super plus blood, were the best grown. The super at 1 cwt. and super plus Ephos at 1 cwt. were equally good, and better than super 2 cwt. and Ephos, which was an easy last. At this stage the super 2 cwt. plots had an unhealthy appearance, and in spite of good conditions were evidently suffering from too great a concentration of soluble material in close proximity to the young plants. The plots recovered later. Fig. 1 shows the appearance of some of the plots on 26th January last. At the time of cutting the Ephos plots were slightly ripier than the remainder, and, if anything, the more heavily manured plots were least ripe.

YIELDS.

The crops were cut and weighed under the methods adopted by the Fields Division in Canterbury, as described in the *Journal* for July, 1926. In the 1925-26 season cutting was done at two different periods on account of slight differences in ripening, and two sets of results were obtained. Relatively the results were much the same, and there seems no occasion to weigh at different periods. The yields for both experiments are shown in the following table:—

Table 2.—Yield Results on Experiments A and B.

Area of individual plot, $\frac{1}{16}$ acre.

Treatments compared, A with B.	Experiment A: Cut 4th February, 1927, 10 weeks 3 days after Sowing.				Experiment B: Cut 26th January, 1927, 11 weeks 1 day after Sowing.			
	Number of Paired Plots.	Tons per Acre.		Differ- ence, Signifi- cant (S.) or Non- signifi- cant (N.S.).	Number of Paired Plots.	Tons per Acre.		Differ- ence, Signifi- cant (S.) or Non- signifi- cant (N.S.).
		Yield.	Differ- ence.			Yield.	Differ- ence.	
A. Super 1 cwt. ..	12	9.38	0.92	S.	10	8.17	2.5	S.
B. Ephos 1 cwt. ..		8.46	..	..		5.67	..	..
A. Super 1 cwt. ..	18	9.12	0.12	N.S.	23	7.73	..	N.S.
B. Super and Ephos 1 cwt.		9.00	..	..		7.93	0.2	N.S.
A. Super 1 cwt. ..	12	9.26	..	..	24	7.87	..	..
B. Super and blood 2 cwt.		10.12	0.86	S.		8.53	0.66	S.
A. Super 1 cwt. ..	18	9.11	..	N.S.	24	7.87	..	N.S.
B. Super 2 cwt. ..		9.43	0.32	N.S.		8.29	0.42	N.S.
A. Super 1 cwt. ..	18	9.12	..	..	24	7.87	..	..
B. Super and Ephos 2 cwt.		9.84	0.72	S.		8.48	0.61	S.
A. Super 2 cwt. ..	17	9.42	..	..	24	8.29	..	N.S.
B. Super and Ephos 2 cwt.		9.84	0.42	S.		8.48	0.19	N.S.

NOTE.—The difference is placed opposite the higher-yielding plot in each case.

Comments on Table 2.

(1) Super at 1 cwt. shows a marked superiority in yield over Ephos at 1 cwt. per acre in both experiments.

(2) Super and Ephos at 1 cwt. per acre does not differ significantly from 1 cwt. of super in yield.

(3) The addition of 1 cwt. of dried blood to the super has caused significant increases in yield in both cases.

(4) 2 cwt. of super shows non-significant increases in both experiments. In view of the certainty attached to the increases from super and Ephos at 2 cwt. (see next comparison) it is highly probable that the benefit from the 2 cwt. of super is real, though small.

(5) Super and Ephos at 2 cwt. per acre shows a considerable increase over the super at 1 cwt. on both farms.

(6) A direct comparison between super at 2 cwt. and super plus Ephos at 2 cwt. reveals a definite increase in favour of the latter in Experiment A, while that in Experiment B is uncertain.

SUMMARY OF COMPARISONS BETWEEN SUPER AND EPHOS: THREE SEASONS' RESULTS.

Table 3 is compiled from the results of the experiments conducted in the Darfield-Racecourse Hill district during the past three years.

Comments on Table 3.

So far as the experiments already conducted are concerned it can be taken as definitely established that super at 1 cwt. per acre is a better form of phosphate for rape than Ephos sown at the same rate. In all the trials enumerated in the table the rape was sown in 7 in. drills, except the first mentioned. This was in 14 in. drills, and in the light of more recent knowledge on the effect of manures on germination it seems probable that the quantity of 1½ cwt. of super applied in that season may have so affected germination as to thin the plants considerably below the number on the Ephos plots. No further work with straight-out Ephos as a rape-manure will be done in Malvern County. The other treatment mentioned elsewhere in this article will be given further trial.

Table 3.—Super and Ephos compared: Three Seasons' Results.

Season.	Yields in Tons per Acre.		Difference in Favour of Super (+) or Ephos (-).	Farm.
	Super* 1 cwt.	Ephos 1 cwt.		
1924-25 ..	5.01	5.39	0.38	W. W. Mulholland Darfield.
" ..	7.05	4.78	+2.27	R. S. Gunn, Racecourse Hill.
" ..	9.21	9.08	+0.13†	J. Symes, Darfield.
1925-26† ..	4.22	3.78	+0.44	"
" † ..	5.31	4.42	+0.89	R. S. Gunn, Racecourse Hill.
1926-27 ..	9.38	8.46	+0.92	J. Symes, Darfield.
" ..	8.17	5.67	+2.50	R. and J. Gunn, Racecourse Hill.

Average increase of super over Ephos, 1.08 tons.

* Both manures were sown at 1½ cwt. per acre in the 1924-25 season.

† The yields in 1925-26 season are the averages of weighings taken at two different periods of growth (see *Journal*, October, 1926, pages 254 and 255).

‡ All differences are highly significant except that shown in italics.

Experiment C.

Date sown, 9th November, 1926; seeding, $1\frac{1}{4}$ lb. per acre in 14 in. drills. History of paddock: 1925-26 and 1924-25, grass; 1923-24, oats; 1922-23, wheat.

As in the previous season, the object of the experiment was to test the effect of method of application of different quantities of (mainly) super on yield and germination. Some modifications of the previous year's trial were made. The treatments used in 1926-27 (with the seeding in 14 in. drills) were as follows:—

- (1) Super $\frac{1}{4}$ cwt. per acre; manure in 14 in. drills.
- (2) Super 1 cwt. per acre; manure in 7 in. drills.
- (3) Super 1 cwt. per acre; manure in 14 in. drills.
- (4) Super 2 cwt. per acre; manure in 7 in. drills.
- (5) Super 2 cwt. per acre; manure in 14 in. drills.
- (6) Super 1 cwt. and dried blood 1 cwt. per acre; manure in 7 in. drills.
- (7) Super 1 cwt. and dried blood 1 cwt. per acre; manure in 14 in. drills.

Seven replications of these treatments were sown, the strips being about 6 chains in length.

NITRATE OF SODA.

From the preceding season's experiment it was obvious that the sowing of a highly soluble nitrogenous manure (sulphate of ammonia in that case) in contact with the seed was likely to be attended by very harmful effects on germination. The top-dressing of nitrate of soda was therefore decided upon. It was applied at the rate of 85 lb per acre, this being the amount calculated to equal the blood in nitrogen content. Application was made by drilling in the nitrate of soda in $\frac{1}{4}$ -chain-wide strips at right angles to the rows of rape. The nitrate-treated strips alternated with similarly dimensioned strips, which, to ensure uniform cultivation on treated and untreated, were drilled only. Fig. 2 shows a portion of the area.

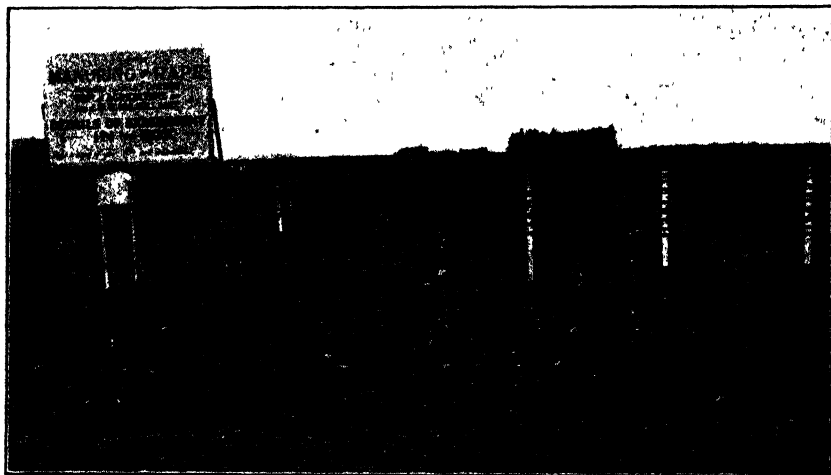


FIG. 2. RAPE EXPERIMENT C (MULHOLLAND'S FARM).

Immediately behind notice-board is an unsown strip; the other comparatively bare-looking strip is a no-manure plot. Pegs between unsown and no-manure strips mark $\frac{1}{4}$ -chain-wide sections of nitrate and no-nitrate.

The nitrate was applied forty-four days after sowing. A fortnight later the effect of the dressing was evident by the treated plots showing a deeper colour, characteristic of the effect of the treatment. The crop was weighed on 27th January, eleven weeks and three days after sowing. No marked differences (apart from the nitrate-treatment strips) in the appearance of the plots could be seen, except that the super and blood in 14 in. drills was darker in colour than the remainder. Table 4 presents a comparison between the different quantities and methods of application. The germination is also shown in this table.

Table 4.—Yield Results of Experiment C.

Area of individual weighed plot, $\frac{1}{16}$ acre.

Treatments compared, A with B.	Yields and Difference in Yields.					Effect of Manures on Germination* ; 56 Counts each Treatment.		
	Spacing of Manured Rows.	Number of Paired Plots.	Tons per Acre.		Difference Significant (\$) or Non-significant (N.S.).	Plants per 10 ft.	Difference in Number of Plants per 10 ft.	Difference Significant (\$) or Non-significant (N.S.).
			Yield	Difference.				
	Inches.							
A. Super $\frac{1}{2}$ cwt.	14	42	3.58	..	..	24.2	..	N.S.
B. Super 1 cwt.	7		3.81	0.23	S.	24.6	..	..
A. Super 1 cwt.	14	12	3.93	..	..	21.8	..	N.S.
B. Super 2 cwt.	7		4.11	0.18	N.S.	22.0	..	..
A. Super 1 cwt.	14	41	3.90	0.13	N.S.	21.8	..	..
B. Super 1 cwt.	7		3.77	.	..	24.6	2.8	S.
A. Super 1 cwt.	14	42	3.93	..	..	21.8	7.3	S.
B. Super 2 cwt.	14		3.96	0.03	N.S.	14.5	..	..
A. Super 1 cwt.	14	21	3.52	..	..	21.8	7.3	S.
B. Super 1 cwt. and blood 1 cwt.	14		3.73	0.21	N.S.	14.5	..	..
A. Super 1 cwt.	7	21	3.48	..	..	24.6	3.0	S.
B. Super 1 cwt. and blood 1 cwt.	7		4.02	0.52	S.	21.6	..	..

* Germination counts taken 22nd December, 43 days after sowing.

NOTE.—In the first four comparisons above the line the yields are computed from plots half of which received a dressing of nitrate of soda, the other half having no nitrate in each case. In the two comparisons below the line the treatment shown had no nitrate of soda.

Comments on Table 4.

(1) Super $\frac{1}{2}$ cwt. in 14 in. *versus* super 1 cwt. in 7 in. drills: The extra $\frac{1}{2}$ cwt. of manure between the seed-rows has caused a slight significant increase in yield to the extent of about $\frac{1}{4}$ ton per acre. The germination is practically the same on both treatments. This is as it should be, considering the same quantity of manure is sown per seed-row in each case.

(2) Super 1 cwt. in 14 in. *versus* super 2 cwt. in 7 in. drills: The slight increase due to the extra 1 cwt. between the seed-rows is not significant. The germinations do not differ significantly, although both are significantly lower than those in the preceding comparison.

(3) Super 1 cwt. in 14 in. and super 1 cwt. in 7 in. drills do not show a certain difference in yield. The germination has been reduced on the former by 2.8 plants per 10 ft.

(4) Super 1 cwt. in 14 in. and super 2 cwt. in 14 in. drills are practically the same in yield. The heavier quantity of manure has had a serious effect on germination, reducing it to 66 per cent. of the 1 cwt. quantity.

(5) The addition of 1 cwt. of blood to the super in 14 in. drills has not yielded a significant increase. The germination has been reduced by the blood to the same extent as in the case of the extra 1 cwt. of super (paragraph 4 above).

(6) The removal of half the blood from direct contact with the seed has allowed a better germination than where the whole was sown in 14 in. drills. The increase of just over $\frac{1}{2}$ ton is highly significant.

(7) The standard method of applying 1 cwt. of super with the seed in 14 in. drills has given practically as good results as any other quantity or method of application of super in the experiment.

Table 5.—Results of Experiment C: Phosphate compared with Phosphate plus Nitrate of Soda.

Treatment.	Spacing of Manured Rows.	Number of Paired Plots.	Tons per Acre.		
			Yield of Treatment shown in Column 1.	Yield of Treatment plus Nitrate of Soda.	Difference in Favour of Nitrate of Soda Addition.
	Inches.				
Super $\frac{1}{2}$ cwt.	14	35	3.25	3.85	0.60
Super 1 cwt.	7	38	3.48	4.42	0.94
Super 1 cwt.	14	35	3.53	4.33	0.80
Super 2 cwt.	7	35	3.76	4.42	0.66
Super 2 cwt.	14	35	3.54	4.31	0.77

NOTE.—All differences shown in last column are highly significant.

Table 6.—Results of Experiment C. Phosphate plus Blood compared with Phosphate plus Nitrate of Soda.

Treatments compared, A with B.	Spacing of Manured Rows.	Number of Paired Plots.	Tons per Acre.		Difference, Significant (S.) or Non-significant (N.S.).
			Yield.	Difference.	
	Inches.				
A. Super 1 cwt. and blood 1 cwt. . .	7	} 33 {	3.99	0.47	S.
B. Super 1 cwt. and nitrate of soda broadcast	7		4.46		
A. Super 1 cwt. and blood 1 cwt. . .	14	} 35 {	3.71	0.63	S.
B. Super 1 cwt. and nitrate of soda broadcast	14		4.34		

Comments on Tables 5 and 6.

In Table 5 each of the straight phosphates is compared with the same phosphate plus nitrate of soda. All the increases are highly significant. Table 6 sets out the relative merits of blood and nitrate

of soda. The nitrate has the advantage in both cases, although it must be remembered that the germinations were different.

Messrs. Mulholland, Gunn, and Symes again gave their keen support to the work, and thanks are due to them. The Fields Division's staff at Christchurch ably assisted in much of the work.

GOOD WATER FOR COUNTRY HOUSEHOLDS.

New Zealand Department of Health.

THE resident in a borough is only very occasionally required to give any thought to the household water-supply, as the problem of securing and supplying a good water has usually been taken over by the local authority. The country resident, however, is in a different position, as he has to face and solve his own difficulties with regard to his water-supply. In many cases dependence has to be placed on tanks; in other cases wells have to be sunk; in still others a natural spring may be used; and some few may tap a natural watercourse or stream. In each of these different cases different difficulties arise; different precautions should be taken; and it is now proposed very briefly to discuss these questions.

Tanks.

The collection of rain-water is perhaps the most common method of securing a water-supply for a country household. The collecting surface is usually the roof. It is rare in the country to use specially prepared areas to collect rain-water. The amount of rain-water collected depends, of course, on two factors: (1) The area of the collecting surface, and (2) the amount of rainfall. Roofs of houses are usually polluted with dust, droppings of birds, leaves of trees, &c., and it is therefore advisable to allow the first of the rain to run to waste. This washes the roof and so ensures a cleaner and purer water. There are various simple contrivances, called "rain-water separators," which allow the first part of a fall to run to waste and then automatically divert the remainder of the rainfall into the collecting-tank.

It is, of course, necessary to see that all spoutings and gutters are kept in a cleanly state. The best storage tank is one of concrete with a smooth inner surface of cement plaster. Rain-water readily attacks metal surfaces, and therefore iron tanks are not so acceptable. In addition, no lead pipes should be used in connection with a water system depending on rainfall, as rain-water can readily dissolve lead. Owing to the fact that it is very soft, rain-water is very useful for laundry and cooking purposes. If the ordinary household supply is "hard," it is an economy to save rain-water for use in the laundry. Rain-water in the country is usually very pure, but this statement does not hold with regard to rain-water collected in towns, where the atmospheric pollution is much greater. As the rain descends it washes the air and collects the impurities such as dust, smoke, and bacteria that may be floating in the atmosphere.

Wells.

Wells are technically known as "shallow" or "deep" wells. With the latter may be included what are known as "artesian" wells. Although depth may have some bearing upon this classification, the question of the ground strata from and through which the water is drawn is of more importance. With the exception of such as flows off the surface into rivers, streams, and lakes, all water deposited on the earth's surface by rainfall which is not evaporated sinks into the ground, and, subject to the varying permeability of the soil and the

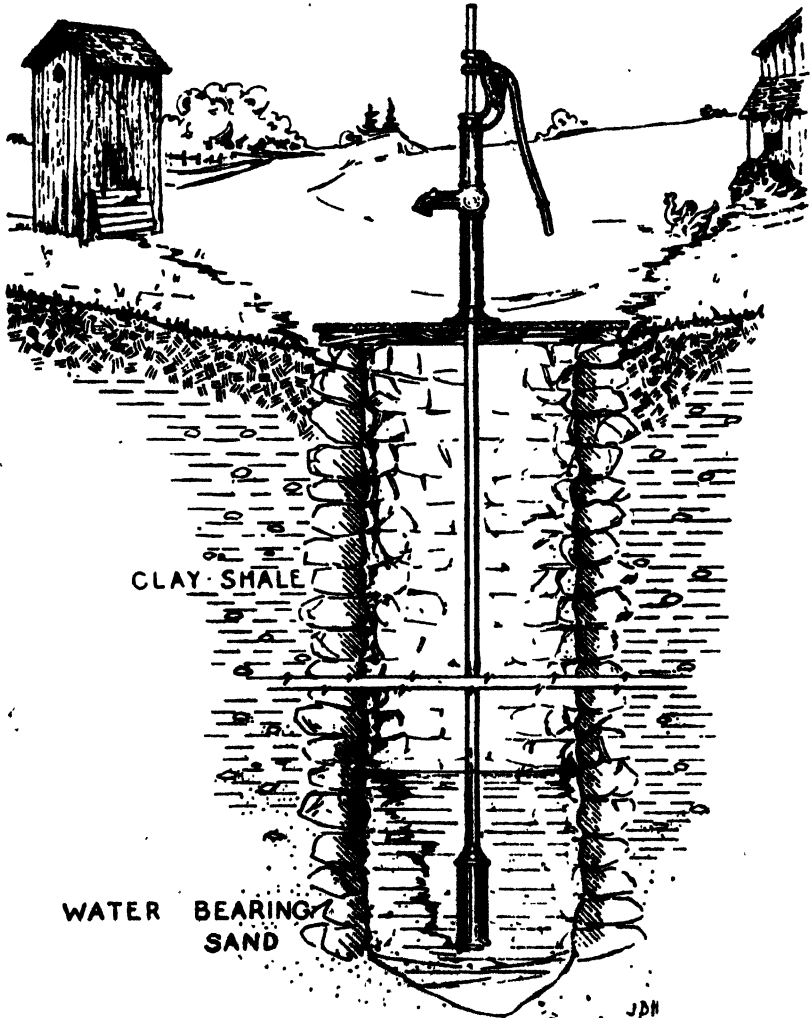


FIG 1. BADLY SITUATED AND CONSTRUCTED WELL.

Water from such a source is liable to pollution, and is therefore unsafe, for drinking-purposes.

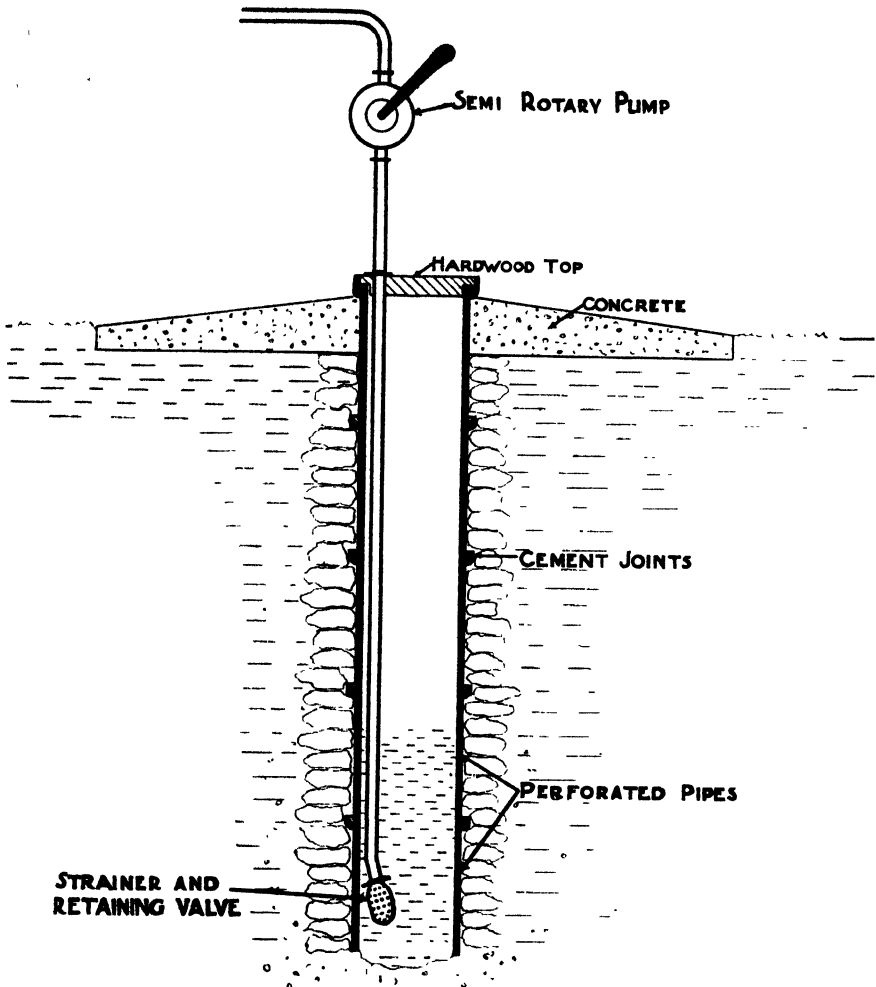


FIG. 2. A BETTER TYPE OF WELL, AFFORDING PROTECTION FROM POLLUTION.

subsoil strata, finds its way to varying depths in the earth and obeys the natural law of gravity by seeking a lower level. There are thus what may be termed "underground streams," the depth of which is determined by the perviousness or imperviousness of the subsoil strata they have met in their passage through the earth's surface. Water which has found its way through the easily permeable strata of the subsoil but has been arrested in its downward progress by an impervious stratum is drawn upon by what are termed "shallow wells." Such water, from its liability to pollution by the organic matter which it may have taken up from the ground upon which it has fallen or through which it has percolated, is of doubtful quality for domestic purposes, and may even be dangerous to health, if such pollution is excretal in origin.

Shallow-well water can therefore never be advocated as a "safe" supply, but where its use is unavoidable, owing to the absence of any better supply, steps must be taken to obviate its pollution, and particularly its pollution by organic matter of an excretal nature. No such well should be driven or sunk at a less distance than 150 ft. from any privy, urinal, sewage-tank, or cesspool, pigsty, stable, or cow-bail. Neither should it be sunk in heavily manured country, particularly land polluted with nightsoil. All nightsoil should be buried well away from its vicinity, and house-drainage should be carried in a direction away from such well. Sanitary conveniences, farm buildings, stables, &c., should be situated where the subsoil water is flowing away from the well.

Protection from surface washings should be afforded by covering the head of the well with a dome-shaped cover of cement concrete of somewhat greater area than the well-head, provided with openings for the pipe main and access to clean the well. The sides from top to bottom should be protected by a lining of impervious material such as glazed earthenware with cement joints, or cement concrete, or brick in mortar with a backing of stiff clay. If any reasonable suspicion of the water is entertained it should be boiled before use for potable purposes.

Shallow-well waters are usually fairly soft and of good use economically for laundry purposes. On the other hand, deep-well waters are usually fairly hard, well aerated, and pure, owing to their having taken up much mineral matter into solution during the lengthier percolation, with its resultant greater filtration, they have undergone. It is usually only necessary to protect such supplies from actual pollution at the source of supply, and to ensure that from the surface down to the impervious stratum, from the under-side of which they are drawn, no surface or shallow-well water gains access. This may be effected by ensuring tight joints in any pipes through which the water is drawn or flows by hydrostatic pressure to the surface in pipe wells, and by lining the well down to the impervious stratum as was previously set out in dealing with the shallow well.

Springs.

Where the water-supply is dependent on natural springs the same precautions in regard to prevention of pollution should be taken as in the case of wells. In addition the area round the spring should be securely fenced off, so as to prevent the access of cattle and other stock. The overflow from the spring should be piped away a considerable distance, so that the surrounding ground is kept as dry as possible. In any case where a spring is used for a water-supply an adequate chemical analysis should be made before the water is used for household purposes. Many springs which supply a clear, sparkling water show evidence on examination of serious and recent pollution.

Control of Chafers.—Attempts are being made by the Department's Biological Laboratory to locate certain species of parasites of North American Scarabaeidae that might be of value in the control of New Zealand chafers.

TOMATO-CULTURE IN ENGLAND.

THE CHESHUNT RESEARCH STATION AND ITS WORK.

Report by T. RIGG, M.Sc., M.A., F.I.C., Cawthron Institute, to the New Zealand Council of Scientific and Industrial Research.*

THE Cheshunt Tomato Research Station is maintained partly from contributions of the tomato-growers in the Lea Valley (Hertfordshire), and partly from grants supplied by the Ministry of Agriculture. The following branches of research in connection with tomato-culture are maintained: (1) Cultural, (2) Chemical, (3) Mycological, (4) Entomological. Dr. W. Bewley is in charge of the station, and has a staff of some twenty workers. Close contact is maintained between the station and the growers by means of public lectures, visitors' days, &c. Free advice is given to all contributing tomato-growers.

Commercial Tomato-culture in the Lea Valley.

In the Lea Valley there are some 1,000 acres of tomatoes under glass. In many respects the conditions of culture are similar to those ruling in the Nelson district of New Zealand. Steam heat is used in the early part of the season, and certain minor differences in construction of houses exist. The English tomato-house is generally higher than the New Zealand house. Ventilation is secured most frequently from ventilators along the ridge-pole, which can be operated from one end of the house. In addition, ventilation at the end of the house is being recommended with a view to the better control of mildew.

The English tomato-grower plants 17,000 tomato-plants to the acre, against the Nelson grower's 12,000 plants. In the Lea Valley the plants are 12 in. apart in the rows, while the rows themselves vary in width from 18 in. to 2 ft.

The English tomato-grower floods his house at the conclusion of the picking season in the autumn. In view of what will be said later in connection with the incidence of "black-stripe," and the possible harmful effects of high concentrations of soluble salts in the top soil, such a practice has much to recommend it. It also ensures that at the commencement of the tomato season the subsoil is thoroughly damp. In our Nelson district there is good reason to suspect that not only does a high concentration of soluble salts operate detrimentally to crop-production, but also that the subsoil at the commencement of the season is not sufficiently damp to give the best results.

It is the custom to use 30 to 80 tons of stable manure per acre in the early winter treatment of the land under glass. A dressing of 2 tons of caustic lime per acre is invariably given. The lime is worked into the soil, and an application of 2 tons of phosphate and 1 ton of sulphate of potash is given as a base treatment. The top-dressing mixture, containing soluble phosphates, sulphate of potash, and soluble nitrogenous manure, is given every fourteen days, commencing when

* Mr. Rigg visited the Cheshunt Station when in England in connection with the recent Imperial Agricultural Research Conference.

the plants are about 2 ft. 6 in. high. Beyond the nitrogen contained in the stable manure it is not the custom to apply soluble nitrogen in the base treatment of the houses.

The following varieties are the most important in tomato-culture of the Lea Valley: Ailsa Craig, Manx Marvel, Stirling Castle, Kondine. In the best houses yields of over 50 tons per house-acre are obtained. This yield compares favourably with the yield obtained by the best growers in the Nelson district.

The pruning of laterals in the English tomato-houses is performed in the case of the best growers by means of a sharp knife. The use of a knife in preference to the use of a thumb-nail undoubtedly diminishes the risk of carrying infection from plant to plant; moreover, disease is not so likely to obtain entry where the knife has been used. Considerable care is taken in the packing of the tomatoes; small boxes containing 12 lb. are used for this purpose.

Experimental Work at Cheshunt.

SOIL-STERILIZATION.

Since the inception of the Cheshunt Station many experiments have been conducted on the sterilization of the soil in tomato-houses. The best results have always been obtained, as in our Nelson district, by the use of steam. In the past the "tray" and the "gridiron" methods have been used for steaming the soil. More recently Dr. Bewley has recommended the use of the "steam-fork," which has proved so successful in Nelson tomato-houses. As might be expected in view of the lower labour costs and lower price of coal in England, the expense in connection with the steam sterilization of Lea Valley tomato-houses is much smaller than that ruling in New Zealand. Dr. Bewley stated that an acre of glasshouse soil could be treated at the cost of £120.

Various experiments have been tried in connection with the sterilization of tomato soil by the means of various chemicals. In certain cases good results have been obtained by the use of cresylic acid and formalin. The chemicals, however, have not proved so reliable as steam treatment. Provided formalin can be obtained at a reasonable price, Dr. Bewley thinks that this chemical is likely to give more consistent results than those of others.

MANURIAL EXPERIMENTS.

Experiments in connection with the manuring of tomatoes have been in progress since the establishment of this research station. The following points seem to emerge as a result of several years' trial: (1) The preliminary treatment of the glasshouses in the autumn with 15 tons of stable manure per acre has given as high yields as those obtained by the use of 30, 60, and 90 tons. (2) Of the three common plant-foods required by tomato-plants, potash and nitrogen are used by the plant in much larger quantities than is the case with phosphate. A liberal supply of both potash and nitrogen has been shown to be necessary in order to secure high quality of tomatoes. The deficiency of these two plant-foods invariably results in an increase in the amount of blotchy fruit. A liberal supply of potash has also been shown to be of great value in controlling black-stripe. (3) Recent experiments

at the research station have shown the great value of green manures when used on land somewhat deficient in organic matter. Grass clippings have proved extremely beneficial in raising crop-production. Dr. Bewley was intensely interested in the green-manuring system of the Nelson tomato-growers, and the experiments conducted by the Cawthron Institute on the value of mustard, turnips, and rape as green manures.

Analyses of tomato fruits and plants, as well as manuring experiments, reveal the very low utilization of phosphate by tomato-plants. It seems very probable that much larger dressings of phosphates are used by tomato-growers throughout the world than are necessary.

Although considerable work has been done by the Cheshunt Station in determining the quantities of various plant-foods which are required for the average glasshouse in the Lea Valley, it has not been possible to make any recommendation which can be considered as final. Fundamental knowledge concerning the physiology of the tomato-plant, and concerning the effect of individual plant-foods on vegetative development, fruit-production, and disease-resistance, is urgently required, in order that the whole question of manuring may be rightly understood.

CARBON-DIOXIDE INVESTIGATIONS.

One of the more interesting investigations of the research station is that connected with the addition of carbon dioxide to the normal atmosphere surrounding the tomato-plants. During the last three years an increase in crop of 16 to 30 per cent. has been obtained by maintaining a concentration of carbon dioxide equal to 0.6 per cent. Formerly the carbon dioxide was produced by the action of sulphuric acid on sodium bicarbonate, but recently the practice has been adopted of burning a special type of fuel in a small Cardyox stove. The stove is lit two hours in the morning and two hours in the afternoon. The fuel is said to burn with the liberation solely of carbon dioxide. The Cardyox stove is a very simple contrivance, which undoubtedly could be purchased at small expense.

BLACK-STRIPE.

As is well known in scientific circles, Dr. Bewley and his colleagues have done considerable work on the disease known as black-stripe. Some time ago he published a paper in which the disease was attributed to the *Bacillus lathyri*. It was shown that inoculation of tomato-plants with pure cultures of this bacillus produced the characteristic brown streak associated with black-stripe. The characteristic symptoms of plants suffering from black-stripe are distinct from those of mosaic-infected plants. He showed me some plants infected with mosaic disease. These plants showed mottling of the leaves, but did not have the brown blaze on the stem which is associated with black-stripe. In the Nelson district tomato-growers commonly hold that a very similar mottling is the forerunner of black-stripe disease.

During the last season an instance of what may be termed "physiological stripe" has occurred in one of the Lea Valley tomato-houses. In this house the tomato-grower changed his soil for loam

obtained at a depth of 3 ft. The house was then manured in the usual way. At a very early stage, after planting, an abnormal condition of the plants was noticed. Pot experiments were instituted at the research station on this glasshouse soil. It was found that the plants developed a brown blaze on the stem very similar to that produced by definite inoculation with *Bacillus lathyri*. This physiological stripe could not be transmitted from plant to plant if such plants were grown on other soil. The bad effects on plant-growth of this particular soil were greatly reduced, or indeed eliminated, by prolonged washing of the soil. It suggests, therefore, that the physiological stripe results from the presence in the soil of some toxic compound. The discovery of this physiological stripe throws new light on the incidence of what we call black-stripe, and obviously much work will be required to elucidate the whole problem. It seems quite probable that in certain Nelson tomato-houses the physiological stripe may operate in addition to the true bacterial stripe.

Dr. Bewley stated that in the treatment of black-stripe they had recommended in the past the initial use of 10 cwt. of sulphate of potash per acre in the base manure. If the plants, when they had reached a height of 2 ft., showed the slightest tendency to black-stripe infection a dressing of 10 cwt. of sulphate of potash per acre was immediately applied. This dose was repeated in fourteen days' time. Quite frequently a dose of nitrogenous manure was necessary in order to encourage vegetative growth following the second application of sulphate of potash.

VARIETY TESTS.

The research station has made many tests of both English and American varieties. Among the American varieties Norduke has been grown, but the results obtained with it have been even more disappointing from the point of view of yield than those obtained from this variety in the experiments of the Cawthron Institute. Both Ailsa Craig and Manx Marvel have given very excellent results in the trials conducted by the Cheshunt Station. The Ailsa Craig tomato is noticeably bigger than that of this variety tested in the Nelson district. The station has produced a new variety as a result of crossing Ailsa Craig, and this promises exceedingly well. Dr. Bewley has very kindly offered seed of his more important varieties, in addition to his cross of Ailsa Craig, for testing in New Zealand.

INVESTIGATIONS ON MILDEW (*CLADOSPORIUM FULVUM*).

Considerable work has been done in testing the resistance of various varieties of tomatoes to mildew. Stirling Castle, Up-to-Date, and Norduke have proved the most resistant. So far none has been found immune.

CONTROL OF RED SPIDER AND WHITE FLY.

Many experiments have been conducted in regard to the control of red spider and white fly (*Trialeurodes vaporariorum*) in tomato-houses. Naphthalene fumigation has been shown to be very successful in the control of red spider. A parasite (a chalcid wasp) has been introduced to control the white fly.

STRATFORD DEMONSTRATION FARM.

NOTES ON OPERATIONS IN 1926-27.

J. W. DEEM, Instructor in Agriculture, and Chairman, Stratford Demonstration Farm Society.

THE season of 1926-27 opened well in the Stratford district, and there was every promise of a good spring. However, about the middle of September the weather broke, and from then on to the middle of December conditions were very bad, rain falling almost every day. This delayed all farm operations and necessitated the sowing of crops in land that was not properly prepared, with the result that some of the crops were lighter than usual. The exceptionally bad spring was also reflected in the milk returns, the continuous cold rain during October and November severely checking pasture-growth. By the end of October the farm was badly poached by tramping, and during November advantage had to be taken of an ensilage stack that had been left over from the previous year to tide the stock over the period of shortage. This again emphasizes the value of a reserve stack of ensilage. In this case we were able to keep the herd going until the feed came away again about the middle of December, after which there was plenty. Had the herd gone back during the month of November it would have been impossible to get the yield up again during December and January, no matter how good the feed.

PASTURES.

A further area of 18 acres was put down to permanent pasture during the year. The farm is now in its tenth year, and so far it has not been necessary to renew any permanent pastures sown during that period. The imported wild white and genuine colonial white clovers continue to show their supremacy over ordinary imported white. On the new areas sown down during the year some further white clover tests have been included, also some tests between various strains of red clover, including Cornish Marl and Montgomeryshire Late-cut. The latter is giving very fine results at the Marton Experimental Area, and there are indications that it is going to do well at Stratford.

Top-dressing Trials.

The Rhenania phosphate mentioned in last year's notes (*Journal*, October, 1926) did not give quite as good results as the basic slag or super on adjoining areas, and there does not appear to be any good reason to continue with this fertilizer. In this year's scheme of top-dressing Seychelles Island phosphate and Sulfurophosphate are being tested. The potash experiments have been extended, and now include kainit, 30 per cent. potash, sulphate of potash, and muriate of potash. So far there is no definite evidence that the addition of any of these potassic fertilizers to the usual phosphatic manures has been advantageous. They are being applied at the following rate per acre per year: Kainit, 2 cwt. ; 30 per cent. potash, 1 cwt. ; sulphate and muriate of potash, $\frac{1}{2}$ cwt. each. Two of the areas have now had kainit for four years in succession, but still fail to show any definite response, nor are

the pastures more palatable to stock. We consider that the money spent on potash would give a much greater return if spent on additional phosphates. Basic slag is still our best fertilizer, but areas treated with basic super, super and lime, super, and super plus Nauru rock phosphate are very satisfactory, while super following slag is giving very good results.

ROOT CROPS.

As mentioned in the introductory paragraph, the spring was a very difficult one for sowing root crops, and many of these were below the average.

Mangolds.—Sixteen varieties of mangolds were grown, a number being Danish and new English varieties or strains. As in previous years, Prizewinner gave the best results in the main crops, being closely followed by Red Intermediate; Sharp's Mammoth Long Red and Wiboltt's Dana Ovid were the best of the others. Our standard manure for mangolds is now three parts super and one part each of bonemeal and Nauru phosphate, at 6 cwt. per acre, plus 3 cwt. kainit or common salt. A carefully conducted experiment has been carried out for the past three years to determine the value of salt, kainit, and sulphate of potash respectively used in addition to phosphatic manures. Table I gives the result, "mixture A" being the standard manure specified above.

Table I

Manure.	1926.	1927	Average of Two Years
	Tons cwt.	Tons cwt.	Tons cwt.
Mixture A, 6 cwt., plus 3 cwt. kainit	42 6	55 7	48 10
Mixture A, 6 cwt., plus 3 cwt. salt	38 10	54 14	46 12
Mixture A, 6 cwt., plus 1 cwt. sulphate of potash and 3 cwt. salt	34 2	55 6	44 14
Mixture A, 6 cwt., plus 1 cwt. sulphate of potash	32 10	51 5	42 0½

Carrots.—Ten varieties were tested, Matchless White again proving best with a yield of 45 tons 3 cwt. per acre, compared with Guerande, 44 tons 19 cwt., and Barriball, 38 tons 15 cwt. The manure used was the mangold mixture A at 5 cwt. per acre.

Swedes.—Nine varieties of swedes were grown, Grandmaster weighing the best with 57 tons 16 cwt., Masterpiece second with 46 tons 9 cwt., and Studsgaard Itamme third with 45 tons 9 cwt., per acre. Several imported varieties, including Bangholm Pajberg and Bangholm Klank strains, that had a reputation for club-root resistance, proved more susceptible than our standard strains, the two Bangholms being practically wiped out. A test was also carried out between seed treated at the Biological Laboratory, Wellington, and untreated seed from the same package. The treated seed showed a much lower germination than the untreated, and a consequently lighter crop, the per-acre yields being 39 tons 3 cwt. and 46 tons 9 cwt. respectively. Club-root was found on both plots. The treatment was mainly in the direction of controlling dry-rot. When weighing, one root affected with dry-rot was found on the treated area, and three on the untreated area. The crop

in this field, both treated and untreated, could be classed as nearly free from dry-rot. This is important, as the same field grew swedes in 1922—the first crop after stumping—and practically the whole of the 1922 crop was lost from dry-rot.

Soft Turnips.—Eighteen varieties were tested, including a number of Danish and new English strains. These roots were grown on land that had been in swedes four years ago, and all were appreciably infected with club-root. There were two or three promising turnips among the new varieties, but nothing so far to warrant them taking precedence over standard varieties such as Imperial or Hardy Green Globe, Red Paragon, and Devonshire Greystone. These varieties are still giving excellent results in Taranaki, and are hard to beat.

CHOU MOELLIER.

Several acres of chou moellier were grown, but the crop was only fair, the lower-lying portions of the field being the poorest; evidently this crop likes good drainage. Chou moellier is very resistant to club-root, but it was found that, although the plants did not die down, club-root greatly retarded the growth of the crops on the wetter areas. An interesting experiment was carried out to test the degree of resistance of the plant. An area of $\frac{1}{2}$ acre was sown in swedes about the middle of December. These germinated well and made splendid growth up to the middle of January, when it was noticed that they were affected by club-root, and by the end of the month practically every swede-plant had gone down with this disease. The area was immediately ploughed and sown with chou moellier, and a splendid, healthy crop was produced which carried right through to August.

DAIRYING RETURNS.

Owing to a change in herd bulls being necessitated a number of the best cows were three to four weeks late in coming into profit. Notwithstanding this fact and the bad spring, the increase in butterfat production for the year was 934 lb., and the total of 19,448 lb. of butterfat actually sent to the factory must be regarded as satisfactory. Table 2 gives details of butterfat production on the farm for the past eight years.

Table 2.

Year.	Butterfat per Cow	Butterfat per Acre.	Yearly Increase per Acre	Total Butterfat.
	lb.	lb.	lb.	lb.
1920	221.1	60.8	..	8,694.4
1921	274.2	88.7	27.9	12,684.1
1922	298.9	104.5	15.8	14,943.5
1923	280.0	98.6	-5.9*	14,099.8
1924	305.0	108.9	10.3	15,572.7
1925	327.0	121.3	12.4	17,345.9
1926	330.5	129.4	8.1	18,511.3
1927	329.6	136.0	6.5	19,448.0

*Decrease.

The season was commenced with fifty-six cows and seven two-year-old heifers; no stock was bought. For various reasons two of the cows

were not milked, and were sold in September. Two cows and two heifers did not come into profit until December and January. This makes fifty-two cows and seven heifers all told, with a return of 329.6 lb. butterfat per head. A further analysis shows that the cows averaged 337 lb. and the heifers 275 lb.

General expenditure on manure works out at 16s. 5d. per acre, but it must be remembered that a fair amount of this is spent in the purchase of fertilizers for experimental purposes, some of which is not of actual value to the farm.

The Manager, Mr. W. J. Grierson, and his assistants have carried out their duties in a very thorough manner, and they are to be congratulated on the results obtained. Mr. A. J. Glasson, Fields Instructor, Hawera, assisted in the sowing and weighing of most of the crops, and the value of his work is greatly appreciated.

PROPERTIES OF SUPERPHOSPHATE.

IN the course of an address to the Board of Agriculture on the subject of the mineral content of pastures, Mr. B. C. Aston, Chief Chemist, Department of Agriculture (who is directing that research in New Zealand), stated with reference to superphosphate that few farmers realized the triple quality of this valuable manure, which, in addition to supplying phosphorus, also supplies large quantities of calcium and sulphur, all three being elements essential to the nutrition of the animal. The response of crops and pasture and the stock grazed on them to superphosphate might therefore not always be solely due to the phosphoric acid. If it was due to the calcium or sulphur there were cheaper ways of supplying them than in super. In any case there should always (except in the case of sandy lands) be enough carbonate of lime in the soil to combine with the superphosphate and prevent the reversion to insoluble, unavailable compounds of iron and alumina. Sandy land, he added, should not be limed, but improvement of its texture sought by means of green-manuring.

MOTTLED HEART OF SWEDES.

A DISEASE of swedes, known as "mottled heart," has been particularly abundant for many years past in Westland, and a considerable amount of experimentation has been from time to time carried out on it. A further set of experiments established in December, 1925, gave some very important results, which are briefly as follows: (1) None of the common artificial fertilizers exerted any deterrent effect upon the disease, which was very prevalent; (2) some of the fertilizers certainly increased the weight of the crop per acre, but this was commonly accompanied by a greater percentage and a greater intensity of the disease; (3) wood-ashes, on the other hand, gave very little improvement in weight per acre of crop; (4) wood-ashes, however, decreased or even eliminated the disease entirely, according to the quantities used; (5) the greater the weight per acre of swedes the greater the requisite quantity of ashes to secure a healthy crop. The experiments commenced at Waimaunga Experimental Farm, Grey Valley, in December, 1926, to ascertain what constituents of the wood-ashes were preventing the occurrence of the disease were entirely destroyed by floods.—*Annual Report of Fields Division, 1926-27.*

Analysis of treated House-refuse.—A sample of the product of the Wellington City Corporation's house-refuse masticator was analysed recently at the Department's Chemical Laboratory. The sample, after drying, contained over 50 per cent. of organic matter, but almost negligible amounts of nitrogen, potash, and phosphates.

SEASONAL NOTES.

THE FARM.

CEREAL HARVEST.

CEREALS should be cut as nearly as possible at the correct stage of ripeness. If cut too early the grain shrivels, and if cut too late there is a risk of a loss by shaking. Four main stages or degrees of ripeness can be easily recognized. In the milky stage the contents of the grain when squeezed are fluid, and if cut at this stage the grain shrivels; next comes the stage of yellow ripeness, when the contents of the grain are doughy and may be easily cut through with the finger-nail; in the fully ripe stage the grain is hard, but the straw yellow; in the final stage, or stage of dead-ripeness, the straw is white and the nodes shrivelled. The time occupied by the grain passing from the first to the fourth stage depends on the season. In hot, dry weather the change is very rapid, and where large areas have to be dealt with a start must be made on the early side.

Wheat should be harvested at a definite stage in yellow ripeness, and this has been described by Hilgendorf ("The Best Stage for cutting Wheat," this *Journal*, June, 1923) as follows: "General aspect of crop—ripe-coloured, but close scrutiny showed green tinge. Straw—all yellow except about 1 per cent., which showed 3 in. of green above the top knot; all knots green. Heads—ripe-coloured except about 1 per cent. still green. Grain—that in ripe heads would not squeeze out any kind of dough, but cut easily with thumb-nail." This stage is the earliest at which wheat can be cut without causing loss in weight from shrivelled grain. The prevalence of strong winds in wheat-growing areas, and the serious loss that is often caused through shaking in a ripe crop, make it unwise to delay cutting beyond this stage of ripeness.

Oats can be cut slightly greener than wheat, and if intended for chaff early cutting is desirable. Oat varieties differ in evenness of ripening and liability to shaking. Duns and Tartars, for instance, shake badly because the grain ripens very unevenly; Garton's Abundance ripens fairly evenly, but loses grain badly if left till quite ripe. Generally speaking, the crop should be cut when there is a nice uniform yellow colour all over, but just before the greenish tinge has entirely gone. The grain should be well filled and fairly firm, but not quite hard.

Barley for malting is usually left till dead-ripe, as if cut before this the germination of the sample is uneven, which is a disadvantage in the production of high-class malt. At the stage of dead-ripeness the ears tend to bend over, the individual grains are hard with pale-yellow wrinkled skins, and the straw is practically dry.

Cereals should be stooked as soon as cut, and the work of stooking is lightened considerably if the binder is fitted with an efficient carrier and the man operating the binder drops the bundles in straight rows. The stooks should be placed so that the prevailing wind may blow straight through. The crop usually requires at least a fortnight in the stook before it is ready to stack or thresh. If stacked, it should not be

threshed until at least six weeks after stacking, so as to allow completion of the sweating process to which the grain is subjected to in the stack.

FEEDING IN RELATION TO PASTURES AND CROPS.

The time of weaning and method of subsequent feeding of lambs depend entirely on the farm-management method adopted under given climate, soil, and topographical conditions. Where sheep are entirely grass-fed, weaning should take place while there is still plenty of good grass available, and the lambs should be placed on the best pastures. In this way they get used to foraging for themselves before the grass goes off in the autumn.

The management of fat lambs is rather different from that adopted for flock sheep. Under North Island conditions it is usually possible to get 80 per cent. or over of Southdown-cross lambs fat off their mothers, and the remaining lambs will be weaned after the last draft of milk lambs has been got away. In the drier, arable farming districts rape is necessary for fattening the majority of the lambs after the grass dries up in midsummer. Lambs should be allowed a day or two on grass paddocks to settle down after weaning before they go on the rape. Rape is a very heating food, and the lambs on this crop should be watched carefully. Mustard is a good dietetic, and should always be sown with the rape. As the mustard matures earlier than rape it should be sown about a fortnight later. A run-off from the rape on to a grass pasture is also desirable.

Early weaning is generally desirable in the case of calves. If weaned at four or five months they get used to foraging for themselves before the grass goes off badly in the autumn. The more adequate feeding of calves during the dry autumn weather is a point which could receive more general attention from dairy-farmers. If the pastures dry up badly the calves should receive some green feed. If soft turnips are being fed out to the milking-cows the calves can be allowed access to these roots before the cows. They usually confine their attention to the leaves, and this will minimize the tainting effect of the turnips when eaten by the cows.

There are two main points to be considered in the provision of supplementary feed for milking-cows in the late summer and autumn: (1) The method of supplying the supplementary feed—whether by annual forage crops, by ensilage, or by permanent forage crops such as lucerne or paspalum; (2) the feeding-value of the fodder—it should be rich in protein.

Annual forage crops are usual on those dairy farms where some grassland has to be renewed each year, while grass ensilage is the more common summer supplementary feed on farms where the pastures are practically permanent. In the selection of annual crops for summer supplementary feeding the important points are the yield, the feeding-value, and the length of time the crop is available for feeding-out. The popularity of soft turnips as a summer and autumn supplementary crop is due to their high yield, high feeding-value, and to the fact that by the use of successional sowings and early- and late-maturing varieties a supply of mature roots can be made available from the late summer to the early winter. The soft turnip, however, has the disadvantage that it taints the milk if care is not exercised. The roots should be pulled the day before feeding and carted out to

a clean grass paddock. There is, however, practically no other annual fodder crop that can equal the soft turnip as far as yield, feeding-value, and length of feeding-period are concerned. Japanese millet has a much lower yield, and, unless grazed in the young stage, a lower feeding-value. Maize, pumpkins, and marrows are rarely ready for feeding-out in the late summer; again, maize is of poorer feeding-value than turnips and marrows, and pumpkins are usually lower in yield.

Provision of summer supplementary feed by means of grass ensilage is cheaper than by means of annual crops, and it also has the advantage that the feed is always on hand when required. The need for summer and autumn feed varies from year to year. When the summer and autumn rainfall is plentiful annual crops yield well but are often not needed, while in dry years, when summer supplementary feed is most required, these crops often do badly. Grass ensilage can, however, be made in years of abundant rainfall and kept for dry years.

Lucerne and paspalum are valuable supplementary crops for the summer and autumn. In wet seasons, when the ordinary permanent pastures are throwing a good supply of feed, the surplus lucerne or paspalum can be saved as hay or ensilage.

—P. W. Smallfield, B.Ag., *Instructor in Agriculture, Ruakura.*

THE ORCHARD.

FINAL THINNING.

By the time these notes appear growers will be able to get a fairly good estimate of their crops for the coming season. Natural dropping will have ceased, and it will be easily determinable whether too much fruit is being left on the trees. As stated in last month's notes, growers are apt to leave too many fruits to mature. Now is the time to further examine the trees, going over them systematically, and removing any fruits likely to interfere with the development of the remainder. This will specially apply to those varieties bearing their fruits in clusters. The aim should be to produce fruits from $2\frac{1}{2}$ in. to $2\frac{3}{4}$ in. diameter, these sizes having been proved the most suitable both for local and overseas markets. Any diseased or misshapen fruits should be removed. It is also advisable to thin off all fruits growing towards the tops of the leaders, thus giving the trees every chance to make a good extension of wood-growth for the coming season. This will specially apply to Sturmers, a variety easily stunted in growth.

SPRAYING OPERATIONS.

Although there may have been little evidence of black-spot up to the present time, it does not follow that crops will remain clean up to the picking season; consequently spraying should not be neglected, although longer intervals may be given between sprayings. As the holiday season is approaching, it is advisable to so arrange the programme that the orchard is sprayed just before the holidays start. By so doing the orchardist can forget all about spray outfits, &c., during the festive season, unless, of course, weather suitable for the development of black-spot intervenes. In such case practically the same strengths can be used as advised last month.

With the hot, dry weather approaching, red mite will probably be on the increase, and efforts will have to be made to reduce it to a minimum. Black Leaf 40, at strength 1-800-1,000, will help to keep this pest in check, and also help to control any leaf-hopper that may have escaped when in the nymph stage. Last season a grower in the Motueka district obtained splendid results in the control of red mite by the use of a 3-per-cent. kerosene emulsion. This was used in February, and the only disadvantage was that a few of the apples were spotted, in all probability owing to the fact that some free kerosene was present. The same grower has already used a 2-per-cent. solution this season, and the results have been very satisfactory.

One more fungicidal spray on the late maturing varieties of pears should suffice, and attention need then only be directed against codlin-moth and pear-slug, using arsenate of lead, 1½ lb. to 2 lb. per 100 gallons water. Stone-fruits must be sprayed up to a week or so before picking if brown-rot has to be controlled; lime-sulphur, 1-125, with the addition of 4 lb. of sulphur paste, will help much to control this disease.

Cherry-growers will probably be troubled with the slug just before the fruit is ready for picking. Hellebore-powder spray is very effective against the slug, and does not stain the fruit. It is also advisable to spray thoroughly as soon as the fruit is off, using arsenate of lead.

CULTIVATION AND COVER-CROPS.

Cultivation of the orchard should be continued all through the coming month by using the disks and harrows. This will help to conserve moisture, and also prepare the land for the sowing of cover-crops. One of the best cover-crops is blue lupin, the seed of which is usually sown towards the end of the month. Other green crops may be left a little later.

HANDLING THE STONE-FRUIT CROP.

Growers will be busy handling the stone-fruit crop about this time, and every consideration should be given to its marketing. It should be remembered that extra care taken in the grading and packing always pays. Unfortunately, too much low-grade fruit is sent to market, tending to reduce the returns for the better grades. All blemished and diseased fruits should be eliminated, and one size only packed in the case; clean cases should be used, and these properly labelled and stencilled.

The regulations with regard to the fair packing of fruit and vegetables should be carefully observed. These regulations prescribe that all fruit sold, or offered or exposed for sale, whether wholesale or retail, in a container shall be packed in such a manner that any fruit exposed to view, or that would be exposed to view if the container were opened in the normal manner, fairly represents in size, maturity, and condition the whole contents of the container. By the due observance of this regulation confidence will be established between grower and buyer, to the advantage of both.

Consideration should be given to the right stage of maturity for picking, according to the distance the fruit has to travel, so that when the fruit is opened for sale it will be as near perfect as possible.

—G. Stratford, Orchard Instructor, Motueka.

Citrus-culture.

Cultivation should receive very close attention at this period ; land which is inclined to be lumpy can usually be reduced to a fine condition while intermittent showers occur—a condition it is nearly impossible to attain with some soils when very dry. Citrus-trees in particular require constant cultivation to conserve moisture, as they make the greatest demand on the soil during the period of minimum rainfall. If for any reason it is not possible to maintain at least 4 in. of fine earth on the surface the trees should be mulched with rough manure or litter at least to the spread of the branches. If such manure is readily available it should be used even in preference to the clean cultivation. A word of warning is necessary in regard to the use of a mulch ; when rough litter or decaying manure is piled up round the trunk of the tree there often occurs a decaying of the bark, which is injurious.

Pinching.—With the new growth well advanced it is possible to estimate its value to the tree for fruiting or extension, but it is generally found that the growth is in excess of requirements. Any surplus can be removed now, and will allow better development and maturity of that allowed to remain. There are also quite a number of shoots which may be partially removed by pinching, which has the effect of inducing more side laterals of a fruiting nature. At this season there will generally be found strong woody shoots growing up through the frame of the tree. These rarely prove of any value, and are best removed right at the base.

Spraying.—Owing to the prolonged flowering-period of the lemons it will be advisable to give periodical sprayings of bordeaux, 4-4-40, in order to protect the new fruits against verrucosis. An examination of the trees prior to such applications should be made to determine if aphid, thrip, or young scale insects are present ; if so, Black Leaf 40, 1 part to 800, should be added. Verrucosis is seldom found on oranges, nevertheless examination should be made for young insects, and Black Leaf applied, or oil 1-60.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

CULLING SURPLUS COCKERELS.

JANUARY is usually a trying month for birds of all ages. This, together with the fact that the plant at this time will be carrying its greatest number of stock, is sufficient to indicate that if the birds are to thrive and do well there must be no weakness in the chain of management. To lessen the risk of overcrowding and its evil effects there should be no delay in culling out all surplus cockerels that have reached an age of about five months. If these are got rid of it will not only mean better conditions for the remaining stock, but will also save labour and money. It should be remembered that once a bird passes the chicken stage it costs more to feed and grows less in value every day.

GREEN FOOD.

For both the growing and adult stock an ample supply of green material is necessary at the present time if the birds are to be maintained in good health. Green food not only greatly assists in keeping the birds in a healthy, thriving state, but it saves to a great extent the more costly foods, and thereby lessens the cost of production. Finely chaffed succulent lucerne, clover, or green oats provide a splendid green food for birds of all ages, while watercress, silver-beet, cabbage, &c., are also suitable. It is always best at this period of the year to provide green material late in the day, so that any of it not readily eaten by the birds will not become dried up and wasted.

THE GROWING STOCK.

The growing pullets must now be given the very best of care, so that they may not fail in their future function of producing late autumn and winter eggs. The slightest setback in a growing bird is never caught up. One thing that must be carefully guarded against is forcing the birds to prematurity. It is time enough to begin feeding a heavy forcing diet when the birds are well developed and are fit to stand the strain. An undeveloped pullet cannot be expected to commence laying at an early age and at the same time make further growth. Indeed, and in a general way, once the pullet commences to lay she ceases to grow. This is because the energy necessary to reach maturity will obviously have been diverted to egg-formation. In short, pullets of any breed should be prevented, if possible, from commencing to lay till they are at least six months old.

While the inclusion of rich foods, such as meat, in the ration for the undeveloped layer is a mistake, this is not to say that her diet should be stinted. The pullets should be fed as well as possible, but on a plain diet of sound grain materials. Green food should be in ample supply, while a good range should be provided if possible. It is impossible to advise as to the daily amount of food a developing bird should receive, as the weather conditions must be taken into account. During extreme hot-weather conditions the young birds are apt to more or less go off their food. The only safe way of making sure that the young birds get all they require is to have food in a dry state always before them. One part good-quality wheatmeal and two parts bran will provide a good dry-mash mixture. This should be supplied in a proper dry-mash hopper, so that the food will not get wasted; moist feed can be given at ordinary feeding-hours. For keeping the young birds steadily growing there is nothing better than good, plump oats, preferably shelled. The latter are now on the market in most places, and when obtainable they should form a large proportion of the growing pullet's grain ration. An inferior grade of unshelled oats should never be fed, as they are next to useless as a poultry-food.

Above all, care should be taken that the growing birds are not tortured by the presence of vermin. These pests breed rapidly at this period of the year, and if they are to be kept in check it is necessary to pay strict attention to cleanliness and give the quarters frequent spraying with a strong disinfectant. No care or attention is too great for the growing pullet.

LIBERAL FEEDING NECESSARY.

One of the worst mistakes in management which has come under my notice during recent visits to poultry plants is the false economy of stinting the laying flock in food. It is almost impossible to overfeed the laying type. It may be said that if you overfeed some birds they will only put on fat. The reply is that this type should have no place in a laying flock. Such stock are fat because they are not of the correct laying type and obviously are not concerned in heavy egg-production. In other words, they utilize the food consumed to make fat and flesh, while the good layers convert it into eggs. If any argument is required to disprove the common fallacy that the heavy-producing bird can be overfed with the right class of food, it is surely the fact that the thinnest birds at this time of year are almost without exception the heaviest layers in the flock. A high-type layer—and this type is now becoming very common in the Dominion—is regarded by many poultry-keepers as a fowl which will give a great artificially induced yield of eggs on a food-supply which will satisfy a bird in its natural state. If a bird is to lay eggs almost every day for the greater part of the year she must have the material to do it with, and at the same time sufficient to maintain her in sound health while undergoing the great strain on her constitution. It is always a sounder policy to reduce the flock rather than reduce or weaken the ration.

On one plant that I recently visited the owner was most anxious to know how to prevent his birds from getting out of their run. He stated that part of the feathers of one wing was cut, and the wire-netting enclosure was 6 ft. high, yet some of the birds got out. After examining the stock the inquiry was easily answered. They were in anything but a thriving condition, indicating that the starving process was in operation, or that the food supplied was of inferior quality. Usually the best layers in the flock give most trouble by getting out of their run, as they must necessarily be heavy feeders. Thus where they are kept on a mere living-diet it cannot be wondered at that they will make every possible effort to get to a free range in order to search for the food that nature demands. In such cases it may be for the purpose of securing green food, grit, or egg-shell-forming material through lime, as in too many cases these essentials are undersupplied.

The good laying bird must be a contented bird; only in this condition can she be expected to do the best. To achieve this, good food and a liberal supply of it are essential; but it should be remembered that the best bird ever bred or the best food ration ever planned will not spell success if the management is wrong in all other respects. Comfortable, well-ventilated, clean houses that are free from insect pests must go with sound and liberal feeding if maximum results are to be obtained.

It may be added that even a well-fed fowl will sometimes be induced to get out of its run where there is a batten on the top. This, of course, is a mistake, as plain wire at the top, centre, and bottom of the posts is all that is required to support the wire netting between the posts. A bird may also be tempted to get out of its run in order to lay its egg in some outside place rather than visit vermin-infested nests which are so common on badly managed plants.

—F. G. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

SWARMING.

THE most important work engaging the attention of apiarists at this season is that of checking the impulse of the bees to swarm. This operation, together with preparations for an active honey-flow, is likely to crowd the beekeeper's time. For the production of maximum crops of honey all experienced beekeepers admit that swarming should not occur, and, while skilful attention is required to eliminate it altogether in most apiaries, it is a common occurrence.

It is natural for bees to swarm, but what condition of the colony causes them to swarm at this particular season, and not at another period, is not quite understood. Were it possible to understand the natural condition which suggests to the bees that it is time to swarm, our efforts could be directed to the control of that condition. Many theories have been advanced as to the cause of swarming. It is contended that swarming is caused by lack of ventilation, overcrowded colonies, and the presence of old queens in the hives. The beekeeper should therefore endeavour to effect a reduction of these causes.

As ventilation plays an important part in controlling swarming, care should be taken to provide sufficient at all times. An effective method is to place blocks 1 in. in height under the two front corners of the brood-chamber. In the very flush of the honey-flow additional ventilation may be given by drawing one of the supers forward over the rest; this forms two additional entrances, and permits the workers to escape to the field without having to traverse the whole depth of the hive.

Space for the storage of honey and additional room for the queen to lay in must be provided in advance of the colonies' requirements. A suitable plan is to give a new brood-chamber comprising two frames of hatching brood, the remainder being frames of foundation or drawn-out combs. Secure the queen and confine her below an excluder in the new chamber. Then place the old brood-nest directly above, thus giving additional work for the young bees, and plenty of room for the queen to lay in. Young queens are essential factors in the successful control of swarming; colonies show less inclination to swarm where the queen is of the current season's rearing. Every effort, therefore, should be made to requeen early in the spring, or, if this practice is not possible, to head each colony with a young queen in the autumn. If this plan is followed, swarming will be considerably reduced in many of the colonies, and attention will only need to be directed to those colonies showing a tendency to swarm.

The method of clipping queens is not generally practised. It consists in cutting off half or more of each wing on one side, and has advantages. It serves to mark the queen, and prevents the swarms from absconding or from settling in high trees out of reach.

FOUL-BROOD.

As advised last month, all hives affected with this disease should be treated immediately, and the colonies got into good order before the main honey-flow commences.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

THE TOBACCO CROP.

THE earlier plantings of tobacco will now commence to develop a spike of flower-buds, and cultivation should be discontinued. When the majority of the plants reach this stage the flower-buds should be broken off—an operation known as “topping.” Usually this topping is done too high, with the result that the leaves do not fully mature nor attain normal size, especially those high up on the stem. On the other hand, if the topping is too low the remaining leaves become coarse, with large woody veins and ribs, and are subject to disease. For this reason the policy to be adopted in topping requires careful consideration of the soil, weather, condition of the plants, and the purpose in view. For flue-cured yellow leaf coarseness is a serious defect, and topping is done generally rather higher than for air-cured brown leaf.

The check given to the plant by topping results in young growth developing in the axils of the leaves, as well as diverting the sap into the leaves themselves and giving them size, body, and texture. The extent of this young growth will depend on the height of the topping operation, but in any case it may be removed at regular intervals as soon as it is large enough to handle. This is known as “suckering.” The quality of the crop of leaves will depend to a great extent on the way this work is done. It must also be carried out promptly, so that the plant may be brought to maturity without loss of time and the harvesting-period reached during the warmer weather, which is of great assistance in making a successful cure.

At the same time the preparation of the curing-barns must be completed in ample time for the harvest, so that this may be carried out without delay as soon as the plants are ready and the weather is suitable.

It should be needless to state that in all the above-mentioned operations traffic through the crop should be carried out in such a way that the leaves are not broken or bruised, as such injuries discount the value of the leaf.

TOMATOES.

Careful feeding and ample ventilation at this season for tomatoes growing under glass will keep the plants healthy, and fill out the remainder of the crop in a satisfactory manner before the main outdoor crop comes on the market.

The outside crop will require close attention, and probably a dressing of fertilizers to help them mature the crop that should now be setting. Continue to keep a sharp lookout for any sign of disease, and when detected deal with it promptly. Select a few plants of good constitution that are carrying a heavy crop of a suitable type. These should be marked and allowed to mature the fruit on the vines with a view to saving it for seed. Store the seed from each plant in a separate package.

Last month's remarks regarding packing cannot be repeated too often. Fall into line with local practice in regard to the size of case, and pack in it fruit of a definite grade of approximate size. Brand with the recognized distinguishing marks. Such concessions to

standard uniformity facilitate the operations of marketing that are of such importance when selling a perishable product. Some packers fear losing the individuality of their pack by such concessions, but that quality will come out if it is there, by consistent maintenance of the grades. Buyers will get to know the name or number of the grower as one that is reliable, and the pack will receive the advantage of being bought with confidence.

MARKET-GARDEN CROPS.

Planting out the winter's crops now demands first consideration. If the weather is inclined to be dry and difficult it would be as well to spray the plants with tobacco concentrate and lead, in order to clean them up well and protect them from insect attack before they are lifted. When lifting the plants select an even grade, rejecting weak and abnormal specimens. The opportunity to set out the plants in dull showery weather should not be missed; much is to be gained by being ready to take advantage of suitable weather.

The celery crop must not be allowed to become dry, and most of these crops as they become established will receive benefit from a small application of nitrates to keep them moving and ready to respond to that short period during the autumn when their growth has to be just about completed.

Growers of late-sown crops of onions attacked by mildew might try dusting the crop with sulphur or spraying with liver of sulphur (sulphide of potassium), at the rate of 1 oz. to 3 gallons. It has been highly recommended by some authorities recently.

Useful autumn crops that may be sown now are dwarf beans, short-horn carrots, turnip-rooted beet, early peas, spinach, and turnips.

GARDEN PLANNING.

As the autumn season is the best time for laying out the homestead garden or making alterations, it is appropriate to give the matter some attention now. Difficulties and dissatisfaction usually arise through plans being carried out before careful consideration has been given to the subject. The importance of the work demands as much care as the designing and specification of the dwellinghouse, and if the same thought is given to it there is no reason why it should not be quite as appropriate and in harmony with the surroundings.

To those who have such work in view the following suggestions are offered: The extent of the garden should be proportioned to the size of the dwelling. The lawns are most satisfactory when they are smooth but follow the natural contour of the land. Access for vehicles is best given by the easiest and generally most suitable route. Gates and other garden architecture should harmonize in design and proportions with the dwelling. Owing to the great amount of work entailed in keeping garden-paths in order they are best reduced in extent as much as possible. Short grass makes the pleasantest walking, and the amount of traffic is unlikely to wear it out in many places where metal walks have been made.

Common mistakes are to plant high inflammable shelter-trees too close to the dwelling, and to disfigure the lawn and make cutting

difficult by planting too many specimen trees and shrubs. Plants for such positions should have very special qualities for such distinction. Another mistake is to form extensive herbaceous borders composed of small groups of plants that require an enormous amount of attention to keep them in order.

In selecting trees, shrubs, and plants for the garden we cannot do better than follow nature. She has a special flora for warm and cold localities, river-flats, hills, and high country, and by adopting them the work is made easier, effective, and most suitable. This character should be brought out strongly, and the planting done chiefly in comparatively large irregular groups. In the higher and exposed situations a liberal selection should be made from the long list of conifers available, together with some of the hardier evergreen shrubs and alpine plants. In such a situation they will thrive as they do nowhere else. In warm localities near the sea, roses, palms (*Phoenix* or *Washingtonia*), selected oleanders and camellias, crimson hibiscus, *bougardia*, *brugmansia*, citrus, vines, *heliotrope* and camphor, *bougainvillea*, *mandevillea*, *bignonia*, and *solanum* climbers all flourish, and if planted in generous groups will provide colour and perfume, and deliver us from the exceeding monotony from which most of our homestead gardens suffer. At one time nothing gave more pleasure than flowering or fruiting plants out of season in an unsuitable climate. Such conflicts with nature were undertaken with great zest, but the prize was obtained at great cost. The modern practice of co-operating with nature to the fullest possible extent not only secures an ample harvest, but harmonizes with the genius of the locality, and attains a distinction to be obtained by no other methods.

Plans for new gardens or alterations to old ones should be carefully planned now for execution during the autumn months.

—*W. C. Hyde, Horticulturist, Wellington.*

THE DEER PEST.

THE last annual report of the State Forest Service refers to this matter as follows: "All (forest) conservation regions report an increase in these vermin, and this Service again places on record its opinion that protection on all species of deer (except moose and wapiti) should be removed for a period of at least three years, and that payment of a bounty on killed deer should be continued during that time. Protection has been removed from this pest on the State plantations throughout New Zealand, and during the latter part of the period under review the Service inaugurated a campaign for the destruction of deer on these areas. This included the payment of a bounty of 2s. per tail on all deer killed in plantations, the carrying-out of poisoning experiments, and the establishment of salt-licks for the purpose of attracting deer to places where they might be easily shot. Forest Service officers acting as receivers of deer-tails for the payment of bounty report the collection of 2,946 tails, of which 2,001 tails were received at Tapanui from the vicinity of the Blue Mountains, Otago."

Soil Survey Work.—Soils of the deteriorated hill country of the Stratford-Whangamomona district have been the subject of inquiry, and some samples have already been taken by the Chemistry Section of the Department. It is proposed to extend this work during the present summer.

TESTING OF PUREBRED DAIRY COWS.

NOVEMBER CERTIFICATE-OF-RECORD LIST.

Dairy Division.

DURING the past month of November 126 cows received certificates under the C.O.R. system; details of the records are given in the appended list.

NEW JERSEY CLASS-LEADER.

Keston Flower, who until recently was leader of the junior two-year-old Jerseys, now goes to the head of the four-year-old class for that breed. As the list shows, she has been issued a certificate on a production of 814.95 lb. butterfat from 14,679.2 lb. milk yielded in 365 days, at a commencing age of 4 years 64 days. This exceeds the previous highest performance for this class, held by Mr. A. J. Smith's St. Lambert's Bell, by a margin of 34.63 lb. butterfat.

Keston Flower, owned and tested by Mr. G. E. Yelchich, of Waiuku, was bred by C. B. Herrold, also of Waiuku. Her dam, Floral Fox, has a C.O.R. for 469.58 lb. butterfat. Her pedigree contains several of the better-known names of the Jersey breed. Eminent's Fontaine appears on the sire's side, and Majesty's Fox twice on the dam's. Doubtless much of Keston Flower's productive ability originated in these two outstanding lines.

So far as the class-leadership record is concerned, the four-year-old Jerseys have always been, comparatively speaking, more or less below the standard of the remaining classes of the breed. It is satisfactory to note that Keston Flower has done much to remove this anomaly.

LIST OF CERTIFICATES ISSUED, NOVEMBER, 1927.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat r.g'd for Cert.	Yield for Season		
				Days.	Milk.	Fat
JERSEYS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb	lb
Oaklands Silky ..	F. W. Cornwall, Bell Block	2	56 240.1	365	9,504.4	595.18
Juanita's Fairy ..	Hellyer Estate, Dunedin ..	2	44 244.9	365	10,204.3	587.68
Proud Janette ..	A. S. W. Hazard, Waimate N.	2	6 241.1	365	8,407.3	587.16
Rosy Creek Comely ..	T. H. Western, Bell Block..	2	43 244.8	356	9,702.0	574.69
Monavale Doreen ..	R. Haylock, Ngaere ..	2	8 241.3	365	9,508.6	564.29
Erinview Dawn ..	J. Murray, Woodville ..	1	335 240.5	365	9,464.7	560.27
Erinview Flatter ..	J. Murray, Woodville ..	2	16 242.1	365	9,074.3	547.79
Queen Ailsa ..	J. Murray, Woodville ..	2	18 242.3	365	9,326.8	544.75
Cupid of O.K. ..	A. E. Watkin, Takanini ..	1	351 240.5	357	8,793.3	530.09
Queen Mirnee's Avola*	J. Murray, Woodville ..	1	304 240.5	365	10,245.4	528.10
Ivondale Scotch Lassie	A. E. Watkin, Takanini ..	2	0 240.5	365	9,123.1	518.04
Erinview Buttercup ..	J. Murray, Woodville ..	1	329 240.5	365	8,771.5	513.71
Jerseydene Maiden ..	T. Wells, Awakino Point ..	2	42 244.7	365	8,895.7	511.63
Waipiko Jocose ..	C. G. C. Dermer, Waipiko ..	2	24 242.9	365	8,343.9	501.14
Tokorangi Dainty Queen.	N. Moore, Tapanui ..	1	279 240.5	365	8,942.6	484.29
Beachville Cuddlesome	S. H. Wearing, Richmond..	2	12 241.7	365	9,267.1	483.67

LIST OF CERTIFICATES—continued.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS—continued.

<i>Junior Two-year-old</i> —continued		Yrs.	dys.	lb.	lb.	lb.
Firland Princess ..	H. J. Addenbrooke, Ngaere	1	351	240.5	365	10,013.4 471.34
Oxford Dale Ena ..	J. T. Entwisle, Cambridge ..	2	10	241.5	365	7,607.2 457.82
Beachville Ventura ..	S. H. Wearing, Richmond ..	1	346	240.5	365	8,321.5 449.79
Pukepapa Melody ..	H. Cole, Tikorangi	2	10	241.5	329	7,457.7 448.93
Ghazal ..	J. C. Davidson, Dannevirke	2	41	244.6	365	6,880.8 446.94
Jerseydale Vera ..	J. Pettigrew, Pihama	1	362	240.5	365	6,729.9 443.05
Corelli's Pearl ..	W. Johnson, Ngaere	2	11	241.6	348	8,165.7 438.45
Middlewood Cowslip ..	A. Stackhouse, Kiwitea	2	4	240.9	365	8,047.7 436.39
Clarissa of Aria ..	M. V. Reeve-Smith, Aria	1	362	240.5	365	7,221.0 435.87
Ivondale Rose Bloom	Dr. C. G. Aickin, Auckland	2	14	241.9	365	7,961.9 435.48
Dainty Lady of O.K.	A. E. Watkin, Takanini	1	295	240.5	365	7,970.0 424.97
Summertime of Tamahere	F. S. Veale, Tamahere	1	335	240.5	355	7,475.2 422.41
Linden Grove Beauty	Mrs. M. A. Gadsby, Stratford	2	4	240.9	365	6,231.4 411.84
Roslyn Genoa Lady	A. J. Harris, Bombay	2	14	241.9	365	6,661.6 408.05
Roslyn Beauty ..	A. J. Harris, Bombay	1	333	240.5	365	6,698.8 403.54
Coniston Baby ..	R. Waterhouse, Ardmore	1	311	240.5	365	6,701.5 402.83
Maori Golden Iris ..	A. E. Watkin, Takanini	1	346	240.5	365	6,984.8 399.22
Spring Hill Dahlia ..	A. J. Harris, Bombay	1	355	240.5	365	6,602.2 398.86
Miro Meadows Darkie	A. A. Ward, Tariki	1	309	240.5	364	6,490.0 397.98
Vernon Golden Willow	D. J. Cooper, Masterton	2	75	248.0	363	6,934.2 394.11
Tauwhare Silver Lining	Dr. C. G. Aickin, Auckland	2	20	242.5	335	7,493.4 388.22
Rotoma Lady Hope ..	J. S. Rae, Taneatua	2	1	240.6	311	6,517.4 381.15
Rotoma Palm ..	J. S. Rae, Taneatua	2	29	243.4	303	6,899.5 378.59
Nettle's Beauty ..	R. Maddren, Winchester	1	327	240.5	365	7,754.5 375.42
Roslyn Favoured Princess	A. J. Harris, Bombay	1	311	240.5	365	6,411.9 368.02
Jersey Lea Fair Maid	J. T. Entwisle, Cambridge ..	1	364	240.5	365	5,997.6 353.47
Maori Guelder Rose ..	A. E. Watkin, Takanini	1	363	240.5	365	6,874.1 353.33
Rotoma Maid ..	J. S. Rae, Taneatua	2	19	242.4	312	5,982.0 341.10
Ribbonwood Girlie ..	Cook Hospital Board, Gisborne	2	58	246.3	321	7,453.3 344.79
Kelvin Dark Beauty	G. Buchanan, Paeroa	1	360	240.5	365	6,227.7 342.00
Waiwetu Bubbles ..	A. J. Miller, Uruti	1	324	240.5	331	6,283.0 341.37
Woodlands Xenia ..	H. C. Sampson, Hillsborough	1	275	240.5	365	5,442.1 333.17
Kelvin Sensation ..	G. Buchanan, Paeroa	1	306	240.5	363	5,759.8 322.34
Woodlands Merry Maiden	H. C. Sampson, Hillsborough	2	29	243.4	271	5,940.4 314.65
Miro Meadows Wai ..	A. A. Ward, Tariki	2	2	240.7	365	5,464.6 304.51
Heatherlea Primrose	H. J. Lancaster, Levin	1	350	240.5	358	6,581.8 301.23
Burrwood Bonnie Maid	J. B. Tonar and Son, Northcote	1	360	240.5	290	4,646.5 253.84
Spring Meadows Twy	D. M. Finnie, Westmere	2	17	242.2	328	4,480.5 253.07
Spring Meadows Mere	D. M. Finnie, Westmere	2	84	248.9	315	4,686.9 252.49
<i>Senior Two-year-old.</i>						
Carhuff Camelia ..	J. O'Donnell, Bunnythorpe	2	287	269.2	365	10,941.4 650.74
Waipiko Greta ..	C. G. C. Dermer, Waipiko ..	2	243	264.8	365	10,321.6 590.53
Raeburn Tiny ..	J. S. Rae, Taneatua	2	206	261.1	344	8,244.5 449.16
Manor Hussy's Island Queen	J. B. Tonar and Son, Northcote	2	138	254.3	365	7,418.0 428.34
Tauwhare Princess ..	Dr. C. G. Aickin, Auckland	2	355	270.0	298	7,576.8 404.93
Raeburn Lady ..	J. S. Rae, Taneatua	2	173	257.8	343	7,061.5 390.12
Coniston Hairbell ..	R. Waterhouse, Ardmore	2	285	269.0	347	7,808.5 376.71
Ivondale Princess Royal	W. H. Jakins, Christchurch	2	330	274.0	324	8,001.3 365.34

LIST OF CERTIFICATES—*continued.*

Name of Cow and Class	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.

JERSEYS—continued.

		Yrs.	dys.	lb.	lb.	lb.	
<i>Three-year-old.</i>							
Tulip's Minta May ..	H. Cole, Tikorangi ..	3	284	305.4	365	12,203.6	746.30
Waipiko Chlorine ..	C. G. C. Dermer, Waipiko ..	3	212	298.2	365	12,465.0	637.43
Snow View Blossom ..	A. J. Miller, Uruti ..	3	345	311.5	345	9,396.8	607.93
Pecan ..	Boon Bros., Poroporo ..	3	354	312.4	341	10,465.1	582.97
Ensley Lady ..	M. G. McArthur, Auckland ..	3	295	306.5	365	9,715.5	579.20
Matai Nui Gladstone ..	C. J. Startup, Eltham ..	3	27	279.7	365	8,943.3	557.32
Waipiko Cajole ..	C. G. C. Dermer, Waipiko ..	3	345	301.5	365	9,611.0	556.90
Glenbriar Fancy ..	G. Taylor, Ngarua ..	3	302	307.2	365	9,301.3	542.52
Peggy of Stonewall ..	W. R. Grant, Timaru ..	3	341	311.1	365	9,901.3	521.33
Bridge View Cream Rose	A. E. Watkin, Takanini ..	3	239	300.9	365	9,338.5	512.11
Floral Fete of O.K. ..	A. E. Watkin, Takanini ..	3	0	277.0	365	9,758.6	511.08
Jet d'Eau ..	A. E. Watkin, Takanini ..	3	343	311.4	365	9,153.7	501.32
Viola of O.K. ..	A. E. Watkin, Takanini ..	3	254	302.4	293	8,306.1	457.09
Ivondale Gold Carnation	T. W. Perger, Waitara ..	3	269	306.9	326	8,365.4	445.22
Eileen's Gipsy ..	Dr. C. G. Aickin, Auckland ..	3	301	307.1	361	8,333.8	442.26
Colmore Owl's Eileen	D. Marra, Dargaville ..	3	349	311.9	267	6,623.7	372.39
Middlewood Rosalind	T. Watson, Wanganui ..	3	357	312.7	217	6,049.4	370.06



ROSINA BUCKMAN (A. S. HAZARD, WAIMATE NORTH).

C.O.R. in Jersey senior two-year-old class: 11,187.6 lb. milk, 675.82 lb. butterfat.

LIST OF CERTIFICATES—continued.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days	Milk.	Fat.

JERSEYS—continued.						
<i>Four-year-old.</i>		Yrs.	dys.	lb.	lb.	lb.
Keston Flower* ..	G. E. Yelchich, Waiuku ..	4	64	319·9	365	14,679·2 814·95
Ivondale Golden Star ..	C. J. Masters, Hunterville ..	4	326	346·1	337	11,417·4 642·00
Marshlands V.C.* ..	G. E. Yelchich, Waiuku ..	4	41	317·6	365	8,199·6 568·74
Heatherlea Gem ..	H. J. Lancaster, Levin ..	4	6	314·1	364	9,480·1 519·52
Vernon Fuchsia ..	D. J. Cooper, Masterton ..	4	28	316·3	365	9,457·9 504·00
Hillview Famous ..	Dr. C. G. Aickin, Auckland ..	4	331	346·6	365	9,448·9 490·23
Meadowvale Machree ..	A. J. Miller, Uruti ..	4	260	339·5	364	8,616·9 478·64
Abberly Lila ..	Boon Bros., Poroporo ..	4	255	349·0	330	7,993·0 464·76
Oakland Leona ..	Dr. C. G. Aickin, Auckland ..	4	313	344·8	365	7,185·2 459·15
<i>Mature.</i>						
Oakden Madge ..	J. O'Donnell, Bunnythorpe ..	8	353	350·0	365	13,433·3 792·52
Waipiko Charissa ..	C. G. C. Dermer, Waipiko ..	7	142	350·0	342	13,343·3 629·32
Alfalfa Madam ..	J. F. Barker, Wardville ..	5	361	350·0	365	10,675·9 622·74
Meadowvale Success ..	A. E. Watkin, Takanini ..	7	3	350·0	365	11,502·2 608·67
Brookley Gem ..	W. Johnson, Ngaere ..	6	54	350·0	365	9,586·0 596·53
Silver Flower ..	A. E. Watkin, Takanini ..	7	325	350·0	365	9,353·8 569·59
Onaero Ladybird ..	Boon Bros., Poroporo ..	5	34	350·0	310	11,233·2 568·35
Palmdale Princess ..	D. Kennedy, Morven ..	5	285	350·0	365	8,110·4 556·21
Buttercup's Beauty ..	C. J. C. Powell, Opuawhanga ..	5	340	350·0	365	9,728·0 551·68
Marshlands Golden Lady ..	A. E. Watkin, Takanini ..	5	362	350·0	365	10,324·3 525·23
Master Pat's Belle ..	G. Buchanan, Paeroa ..	5	41	350·0	365	9,276·7 488·28
Ivondale Silver Link ..	Dr. C. G. Aickin, Auckland ..	7	334	350·0	365	8,890·6 478·06
Mountain View Cream ..	W. A. Burgess, Ruawai ..	5	300	350·0	365	8,596·4 467·62
Sterula ..	J. S. Rae, Taneatua ..	5	315	350·0	333	7,877·7 461·08
Richwood Mary ..	W. A. Burgess, Ruawai ..	6	66	350·0	357	7,721·7 402·46
Maori Cloudy ..	Dr. C. G. Aickin, Auckland ..	5	7	350·0	365	7,455·4 360·15
Mauriaena Laura ..	Dr. C. G. Aickin, Auckland ..	5	262	350·0	365	6,308·1 354·80
FRIESIANS.						
<i>Junior Two-year-old.</i>						
Carlownie Duchess ..	R. K. Macdonald, Edendale ..	2	17	242·2	364	13,339·8 460·27
Sylvia† ..	Bloomfield Farm Co., Wellington ..	2	47	245·2	365	10,935·1 437·42
<i>Senior Two-year-old.</i>						
Paeroa Model Cadillac ..	A. S. Elworthy, Timaru ..	2	217	262·2	365	15,053·0 549·12
Hillside Heather Queen* ..	Mickell Bros., Te Horo ..	2	335	274·0	365	12,052·2 495·40
<i>Junior Four-year-old.</i>						
Choice Segis Star* ..	H. W. Reeve, Waitoa ..	4	48	318·3	341	16,747·7 607·28
Paeroa Netherland Butter Girl* ..	A. S. Elworthy, Timaru ..	4	23	315·8	365	16,167·4 536·52
<i>Senior Four-year-old.</i>						
Rosevale Sylvia Lassie* ..	Mickell Bros., Te Horo ..	4	363	349·8	355	15,356·0 612·29
<i>Mature.</i>						
Evergreen Mercedes* ..	Smart and Son, Tikorangi ..	6	355	350·0	287	15,795·7 718·36
Hillside Duchess* ..	Mickell Bros., Te Horo ..	5	90	350·0	334	15,021·6 556·02
Carlownie Tirania† ..	R. K. Macdonald, Edendale ..	8	323	350·0	324	18,167·4 532·93

LIST OF CERTIFICATES—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
MILKING SHORTHORNS.						
<i>Junior Two-year-old</i>		Yrs. dys.	lb.		lb.	lb.
Matangi Princess Elizabeth	Ranstead Bros., Matangi ..	2 13	241·8	365	7,778·7	360·24
Matangi Gipsy 4th ..	Ranstead Bros., Matangi ..	1 35	240·5	365	7,834·4	330·53
Matangi Princess Jewel	Ranstead Bros., Matangi ..	2 15	242·0	344	5,769·1	293·19
Matangi Princess Dorothy	Ranstead Bros., Matangi ..	2 20	242·5	328	6,222·3	260·41
<i>Senior Two-year-old.</i>						
Matangi Elizabeth 3rd	Ranstead Bros., Matangi ..	2 33	274·2	365	9,727·5	484·07
<i>Junior Four-year-old.</i>						
Matangi Princess 5th*	Ranstead Bros., Matangi ..	4 21	315·6	353	13,242·9	544·43
<i>Mature.</i>						
Matangi Pauline† ..	Ranstead Bros., Matangi ..	8 84	350·0	291	9,496·7	450·15
AYRSHIRES.						
<i>Two-year-old.</i>						
Glangyle Mountain Mist	McAdam Bros., Queenstown	2 16	242·1	352	5,754·8	292·46
Glangyle Bessie ..	McAdam Bros., Queenstown	2 06	247·1	312	5,626·9	252·64
<i>Three-year-old.</i>						
Ivanhoe Ena ..	McAdam Bros., Queenstown	3 32	300·9	277	6,989·7	339·26
<i>Second-class Certificates.</i>						
Friesians.						
Totara Ruby Ripple*	Piri Land Co., Auckland ..	2 27	367·8	365	15,537·7	521·29

CONTROL OF BLACKLEG IN YOUNG CATTLE.

IN his annual report for 1926-27 the Director of the Live-stock Division remarks: "Owing to the steady campaign carried out by officers of the Department against blackleg in parts of the Taranaki and Auckland Provinces the position in recent years has become less acute, and the mortality amongst young cattle has been reduced to such an extent that it was possible during recent years to relax the regulations in the Auckland District, so that calves were only inoculated on farms where an attack of the disease took place. As a result of the experience gained in the Auckland District the same methods were during the past season introduced into the Taranaki District and were found to work satisfactorily. Our present system, while safeguarding the health of stock, has been an enormous saving in labour both to officers of the Department and stockowners in the district. The regulations with regard to removing young cattle from the district are still in force."

Registration and Inspection of Plant Nurseries.—The annual report of the Horticulture Division for 1926-27 states that this work proceeded satisfactorily, the bulk of the nurseries being comparatively free from disease. There was an increase in the number of nurseries registered, the total being 637, as against 593 for the previous year; £637 was collected in registration fees.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

GRASS MIXTURE FOR HARD BEECH RIDGES.

P. COATES, Pohokura :—

Could you advise as to a suitable grass mixture for hard sandstone beech ridges on bush and fern burns in this district? I think the stocking and conditions would be too hard for Lotus major. Subterranean clover I have not yet properly tested, but it does best on the better low lands. Danthonia is the ideal thing but very uncertain to establish. Brown-top is our mainstay, but gets weak and dried up on hard knolls, especially in winter. Would Lotus corniculatus be better on hard hills than major? Would you advise sweet vernal? I am told Bokhara clover is of no value. We are troubled with short hard bracken and weeds on dry knolls.

The Fields Division :—

The type of ridges you refer to are specially hard, and it is difficult to get any grass to hold on them without top-dressing, which may not be an economic proposition on this class of land. Reliance will have to be placed on grasses such as brown-top and danthonia. Lotus major should prove the most useful of the Lotus family. Sweet vernal provides a certain amount of feeding, but is usually introduced in sufficient quantities as an impurity with other seeds. Subterranean clover is worth further trials, but, as you say, will probably do better on the stronger land. For sowing after a bush-burn the following mixture is recommended. Cocksfoot, 4 lb.; brown-top, 2 lb.; perennial rye-grass, 5 lb.; Italian rye-grass, 5 lb.; crested dogtail, 2 lb.; Danthonia pilosa, 2 lb.; Chewings fescue, 1 lb.; colonial white clover, 1 lb.; suckling-clover, $\frac{1}{2}$ lb.; subterranean clover, $\frac{1}{2}$ lb.; yarrow, $\frac{1}{2}$ lb.; Lotus major, $\frac{1}{2}$ lb.; paspalum, 2 lb.: total, 25 $\frac{1}{2}$ lb. per acre. For sowing after second-growth and fern burns the following is a suitable mixture: Perennial rye-grass, 4 lb.; Italian rye-grass, 4 lb.; brown-top, 2 lb.; Danthonia pilosa, 2 lb.; crested dogtail, 2 lb.; Lotus major, $\frac{1}{2}$ lb.; colonial white clover, 1 lb.; subterranean clover, $\frac{1}{2}$ lb.; yarrow, $\frac{1}{2}$ lb.; Chewings fescue, 1 lb.: total, 17 lb. per acre. If any of the species mentioned in this mixture are already fairly established on the land it may be cut out. The rye-grasses will not hold long unless top-dressed, but they provide feed in the early stages, and thus attract stock to help in the control of second growth while the more permanent grasses are being established.

CONTROL OF BROWN-ROT ON APRICOTS.

M. B. FORD, Timaru :—

On page 130 of the *Journal* for August, 1926, the spray indicated for brown-rot of stone-fruits at petal-fall is lime-sulphur, 1 in 120, or self-boiled lime-sulphur, 8-8-50. In the column "Remarks" it is stated that "apricot-trees should not be sprayed with lime-sulphur spray." Would you kindly advise me what preventive treatment is best to adopt for this fruit. Also, is self-boiled lime-sulphur, 8-8-50, made by mixing 8 parts quicklime and 8 parts powdered sulphur direct with 50 parts water?

The Horticulture Division :—

The sulphur sprays when applied to apricots in summer, while to some extent controlling brown-rot, are distinctly injurious to the crop. The best means known at present of controlling fungus disease attacking that crop is thorough sanitation at all seasons of the year, and an application of home-made bordeaux spray, 8-6-40, when the blossom is in the pink stage. Self-boiled lime-sulphur is prepared by placing 8 lb. flowers of sulphur and 8 lb. rock lime in a barrel and adding water gradually, keeping the ingredients wet but not submerged. Stir occasionally. When thoroughly slaked, dilute at once up to 50 gallons of water and apply the spray.

CALVING-AGE FOR HEIFERS. "

E. TUCKER, Aramoho :—

Would you please tell me the best age for Jersey he

Maximum Fall.	Average November Rainfall.
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The Live-stock Division :—

This matter is governed by many circumstances—¹ inches. and custom being the most noteworthy. From a 1.31 point of view your question is easily answered. The 1.85 animal is placed under a very great strain if bred from to .69 be permitted to reach as near maturity as convenient. 1.40 should calve at about three years old. This is much older than 1.4 be the prevailing custom. For various reasons heifers are 1.4 fifteen months, calving at two years. But no reason can justify such a Breed characteristics may be gained by breeding from a mere baby 1 expense of constitution and after-production. The practice, in 1

Inches.
3.60
2.73
3.72
3.18
3.24
3.44
7.08
9.13
10.77

POACHING OF RIVER-FLAT PASTURES.

"SUBSCRIBER," Te Mawhai :—

I should be obliged for advice as to treatment of my well-grassed heavy river-flat pastures. In winter the cows trample out and destroy the grass and puddle the soil, which sets hard at the first dry weather. The hard-baked condition appears to be only 6 in. to 8 in. deep. Would heavy liming be a remedy? If so, what quantities and when should I apply?

The Fields Division :—

From your account of the river-flat pasture it appears that you should look to drainage as an initial step towards improving the condition of the soil. If the drainage is adequate and satisfactory you should not get the poached condition in winter and consequent hard-setting when the dry weather comes on. Another consideration is that of stocking. Overstocking naturally tends, when the ground is wet, to poaching of the surface soil. Heavy liming would have a tendency to make the soil of the river-flats more friable, but it must be remembered that such treatment would only help to ameliorate a condition brought about by inadequate drainage and possibly overstocking.

IDENTIFICATION OF STOATS AND WEASELS

E. H. AITKEN, Pleasant Point :—

Would you please tell me what is the difference between a weasel and a stoat. I always understood that a weasel had a thin tail, and that a stoat was a similar animal with a black brush tail. The other day I was told that both are stoats, one being male and the other female, and that a weasel is rarely seen in New Zealand and is a white animal.

The Live-stock Division :—

The stoat is closely allied to the weasel, from which it is chiefly distinguished by its superior size and the black tip on the tail, which is always black even if the fur is white; but the throat and under parts are never so white as in the weasel, and the tail is much longer and more bushy with black tip. The weasel is much smaller and more slender. In colour during summer the under parts are usually of some mahogany shade; the throat and chest are always white, the body and outer side of the legs the same as the body, generally a reddish-brown. The tail is short, round, not bushy, pointed, and of the same colour as the back.

NOTE.—"Inquirer, Levin" (inquiry regarding cow with catarrh), should supply his name, in order that an answer may be made.

RECORDS : NOVEMBER, 1927.

Dominion Meteorological Office (Dr. E. Kidson) reports as

usually a month of rapid air-movement and quick changes in the weather it was exceptionally so. It was remarkable also for the number of cyclones, or centres of low pressure, passed either in proximity to New Zealand. At the same time depressions of the same type were also fairly numerous. In this type no low-pressure centre was covered by our weather charts, but the pressure is low over the southwards, and westerly winds prevail. The fluctuations of the pressure are then relatively slight, and, except on the west coast of the South Island and in southern Otago, rainfall is generally light.

general rains during the month—namely, those of the 1st, 5th, and 11th, associated with cyclonic depressions whose centres passed over the

The last of these was the most severe. Its centre was located off the south coast on the 26th November, and by the morning of the 28th had reached the east coast of New Zealand just south of Napier. Southerly gales were experienced on the 28th and 29th in east-coast districts between East Cape and Lyttelton and in the central districts, and very low temperatures prevailed. In many places the gale was the worst experienced for a number of years, and cold and wind combined caused much damage to vegetation. There was also some loss of shorn sheep.

On the morning of the 24th an intense cyclone was centred off the south coast of New South Wales. During the next twenty-four hours it moved with extraordinary rapidity, so that by the next morning it was centred about Foveaux Strait. It affected chiefly districts south of New Plymouth and Castlepoint, strong north-westerly winds prevailing. Heavy rain fell in parts of the western districts.

The westerly type of weather prevailed from the 7th to the 13th and from the 17th to the 22nd.

The rainfall for the month exceeded the normal in all parts of the South Island except central and south-western Otago. In the North Island it was above normal southwards of Raglan and Napier, but below it in the Auckland Peninsula and the Bay of Plenty and Gisborne districts.

On the whole the month was a dull and wet one, with temperatures considerably below the November mean. In consequence the growth of crops, pastures, &c., was checked. Shearing also was delayed in some districts.

RAINFALL FOR NOVEMBER, 1927, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
<i>North Island.</i>				
	Inches.		Inches.	Inches.
Kaitiaki	1.84	11	0.50	3.27
Russell	0.08	4	0.50	2.26
Whangarei	1.30	8	0.65	3.00
Auckland	1.03	13	0.45	3.26
Hamilton	2.17	17	0.50	4.04
Kawhia	4.72	18	1.04	4.49
New Plymouth	7.16	18	1.60	4.61
Riversdale, Inglewood	11.44	18	2.42	8.95
Eltham	5.80	16	2.00	3.35
Whangamomona	8.25	13	2.15	7.40
Tairua	2.10	6	0.86	3.53
Tauranga	1.45	11	0.32	3.29
Maraekakaho Station, Opotiki	2.32	10	0.60	3.04
Gisborne	0.65	8	0.21	3.02
Taupo	3.47	8	0.73	3.41
Napier	1.37	9	0.37	2.51
Maraekakaho Station, Hastings	2.58	14	1.02	2.03

RAINFALL FOR NOVEMBER, 1927—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
<i>North Island—continued.</i>				
Taihape	5·19	20	1·31	3·69
Masterton	6·60	18	1·85	2·73
Patea	7·32	17	1·69	3·72
Wanganui	5·82	12	1·40	3·18
Foxton	5·08	15	0·84	3·24
Wellington	5·72	19	1·20	3·44
<i>South Island.</i>				
Westport	8·74	26	1·56	7·08
Greymouth	9·67	22	1·92	9·13
Hokitika	11·32	20	2·26	10·73
Ross	15·73	14	4·43	13·94
Arthur's Pass	13·68	14	4·23	15·50
Okura, Westland	7·98	8	1·94	12·96
Collingwood	10·82	17	2·48	7·68
Nelson	4·34	13	1·64	2·93
Spring Creek, Blenheim	3·57	15	1·35	2·42
Tophouse	5·65	22	0·92	6·62
Hanmer Springs	6·60	15	1·50	2·74
Highfield, Waiau	4·60	12	1·06	2·51
Gore Bay	5·24	20	1·70	2·05
Christchurch	3·06	19	1·08	1·87
Timaru	2·66	21	0·58	1·96
Lambrook Station, Fairlie	4·00	8	0·90	2·01
Benmore Station, Clearburn	2·66	12	0·64	2·05
Oamaru	2·64	10	0·68	1·93
Queenstown	1·28	11	0·33	2·74
Clyde	0·95	6	0·42	1·36
Dunedin	2·99	17	0·40	3·27
Wendon	3·67	17	0·73	2·54
Gore	4·01	23	0·81	3·31
Invercargill	5·30	21	0·75	4·40
Puysegur Point	5·25	23	0·75	8·36

Bush-sickness Control.—In his annual report for 1926–27 the Department's Chief Chemist (Mr. B. C. Aston) mentions that during the year a number of field experiments using iron compounds for top-dressing permanent pasture were inaugurated by Mr. R. E. R. Grimmer (then stationed at Rotorua), and in this way 10 tons of sulphate of iron were distributed to farmers in the affected districts to be used in co-operative experiment investigations with superphosphate, the farmers supplying the cattle themselves. The use of iron ammonium citrate has considerably increased; the action of the Department in supplying this drug to farmers at cost price has, judging from the sales, been much appreciated. Over a ton of this drug has been sold to farmers in small parcels of a pound or so at a time. Instructions for its proper use were published in the *Journal* for August, 1926.

Importation of Sausage-casings.—Regulations under the Stock Act, governing the importation of sausage-casings into New Zealand, were gazetted on 29th September. The main provision is one requiring that the casings in every shipment must be certified as derived from animals which had received ante-mortem and post-mortem veterinary inspection, and were found free from disease; further, that the casings were sound and fit for human consumption, and not treated with preservatives.

ESTIMATES OF THE SEASON'S LAMBING.

FOLLOWING are complete estimates of the current season's lambing, computed from estimated average percentages furnished by Inspectors of Stock in the various districts. Corresponding figures for the five previous years, together with the actual numbers of lambs tailed, are also given for comparison.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
NORTH ISLAND.				
1927	7,905,432	87.28	6,899,861	..
1926	7,503,200	84.35	6,329,338	6,459,775
1925	7,463,735	85.64	6,391,812	6,345,218
1924	7,148,949	85.00	6,049,654	6,199,881
1923	7,170,154	91.34	6,549,143	6,170,673
1922	6,771,482	90.36	6,118,530	5,955,081
SOUTH ISLAND.				
1927	6,926,298	86.17	5,968,979	..
1926	6,445,052	84.79	5,465,361	5,609,906
1925	6,251,488	78.61	4,914,046	5,090,562
1924	5,927,145	87.87	5,208,378	5,267,266
1923	5,892,849	83.99	4,949,313	4,962,663
1922	5,724,572	82.53	4,724,475	4,949,440
DOMINION.				
1927	14,831,730	86.76	12,868,840	..
1926	13,948,252	84.57	11,794,699	12,069,681
1925	13,715,223	82.43	11,305,858	11,435,780
1924	13,076,094	86.14	11,258,032	11,467,147
1923	13,063,003	88.02	11,498,456	11,133,336
1922	12,496,054	86.77	10,843,005	10,904,521

—Live-stock Division

PRECAUTIONS AGAINST SPREAD OF FIREBLIGHT.

REGULATIONS GOVERNING REMOVAL OF CERTAIN PLANTS AND BEES FROM NORTH ISLAND.

THE regulations under the Orchard and Garden Diseases Act published respectively in the *Gazette* of 18th June, 1920, and 28th May, 1925, governing the removal of certain plants and bees from the Auckland and North Auckland Land Districts, and the counties of Patea, Waitotara, and Wanganui, were revoked by Order in Council dated 6th June, 1927, and the following new regulations issued in lieu thereof:—

1. In these regulations "Plant" includes any portion of a plant, excepting fruit: "Disease" means the disease known as fireblight (*Bacillus amylovorus*).

2. No person shall send or bring any plant of any variety of apple, pear, quince, or crataegus (hawthorns) from the North Island into any other portion of New Zealand: Provided that nothing in this regulation shall apply to the sending by an officer of the Department of Agriculture under proper safeguards of any plant of any of the above-mentioned kinds for the purpose of identification of disease.

3. (1) No person shall send or bring any package of trees or shrubs, or portions of trees or shrubs, from the North Island to any other portion of New Zealand unless such package is accompanied by a certificate, in the form set out in the Second Schedule hereto, signed by or on behalf of the consignor, stating that no plant or portion of a plant of any variety of apple, pear, quince, or crataegus is contained in the package.

(2) The certificate shall be endorsed on a tag or label securely attached to the package in a prominent position.

(3) No person shall carry or despatch or deliver for purposes of despatch to any officer of the Post Office or the Railway Department or any other person any package containing trees or shrubs or portions of trees or shrubs intended to be sent from the North Island to any other portion of New Zealand, and not having attached thereto as herein provided the certificate required by this regulation.

4. (1) No person shall send or bring any bees from the North Island to any other portion of New Zealand unless such bees have been effectively quarantined at a place of quarantine as provided by this regulation for the six days immediately prior to their despatch from that Island, so as to prevent their having access to any flowers or other vegetation.

(2) The Director of the Horticulture Division of the Department of Agriculture shall appoint such places of quarantine within the North Island, and shall impose such conditions for their use, as he deems necessary.

(3) After completing the prescribed period of six days in quarantine the bees shall be forwarded direct from the place of quarantine to their final destination, an official permit in the form set out in the Third Schedule hereto or to the like effect, signed by an officer of the Department of Agriculture, being attached by tag or label to each parcel of such bees.

(4) No person shall carry or despatch or deliver for purposes of despatch to any officer of the Post Office or the Railway Department or any other person any package containing bees intended to be sent from the North Island to any other portion of New Zealand and not having attached thereto as herein provided the permit required by this regulation.

(5) All expenses of sending bees to a place of quarantine and of forwarding them on completion of their period of quarantine to their destination outside the North Island shall be borne by the original sender of such bees, and shall be payable on demand.

(6) The officer of the Department of Agriculture in charge of any place of quarantine may in his discretion, before accepting any bees intended to be dealt with under this regulation, require the person delivering the same to him to prepay to him the estimated expense of sending the same to their destination.

(7) Every person who does or omits any act in contravention of these regulations, or signs any certificate under these regulations which contains a false statement, commits an offence, and is liable on conviction to a fine not exceeding £20.

The regulations came into force on publication in the *Gazette* of 9th June, 1927, in which the several schedules may be seen.

AGRICULTURAL SHOWS, SEASON 1927-28.

THE following show-dates, for the remainder of the current season, have been notified by agricultural and pastoral associations:—

Nuhaka A. and P. Association : Nuhaka, 1st January, 1928.
 Marton District A. and P. Association : Marton, 18th January.
 Waipukurau A. and P. Association : Waipukurau, 20th January.
 Palmerston and Waihemo A. and P. Association : Palmerston, 20th January.
 Horowhenua A. and P. Association : Levin, 24th and 25th January.
 Tapanui Farmers' Club : Tapanui, 25th January.
 Rangitikei A. and P. Association : Taihape, 25th and 26th January.
 Helensville A. and P. Association : Helensville, 30th January.
 Golden Bay A. and P. Association : Motupipi, 1st February.
 Woodville A. and P. Association : Woodville, 3rd and 4th February.
 Omaha and Pakiri A. and H. Association : Leigh, 4th February.
 Clevedon A. and P. Association : Clevedon, 4th February.
 Feilding A. and P. Association : Feilding, 7th and 8th February.
 Te Puke A. and P. Association : Te Puke, 8th February.
 Dannevirke A. and P. Association : Dannevirke, 8th, 9th, and 10th February.
 Hikurangi-Otonga A. and P. Association : Hikurangi, 9th February.
 Masterton A. and P. Association : Solway, 14th and 15th February.
 Te Awamutu A. and P. Association : Te Awamutu, 15th February.
 Taumarunui A. and P. Association : Taumarunui, 15th February.

Buller A. and P. Association : Westport, 17th and 18th February.
 Ohura A. and P. Association : Matiere, 22nd and 23rd February.
 Franklin A. and P. Association : Pukekohe, 24th and 25th February.
 Tauranga A. and P. Association : Tauranga, 29th February.
 Hukerenui Agricultural Association : Hukerenui, 1st March.
 Mongonui County A. and P. Association : Kaitaia, 3rd March.
 Opotiki A. and P. Association : Opotiki, 6th March.
 Taranaki Agricultural Society : New Plymouth, 7th and 8th March.
 Matamata A. and P. Association : Matamata, 13th March.
 King-country Central A. and P. Association : Te Kuiti, 15th March.
 Kaikoura A. and P. Association : Kaikoura, 16th March.
 Hawke's Bay A. and P. Society : Autumn Show, Tmoana, 17th March.
 Mayfield A. and P. Association : Mayfield, 17th March.
 Hawarden A. and P. Association : Hawarden, 23rd March.
 Methven A. and P. Association : Methven, 29th March.
 Oxford A. and P. Association : Oxford, 5th April.

CROP AREAS AND YIELDS: SEASONS 1925-26 AND 1926-27.

Crop.	1925-26		1926-27.	
	Area.	Yield per Acre.	Area.	Yield per Acre.
	Acres.		Acres.	
Wheat—				
Grain	151,673	30.44 bushels	220,083	36.13 bushels.
Chaff, &c. ..	857	1.35 tons	928	1.87 tons.
Oats—				
Grain	102,485	40.14 bushels	117,326	42.58 bushels.
Chaff, &c. ..	245,026	1.45 tons	255,372	1.70 tons.
Barley—				
Grain	25,969	30.47 bushels	29,886	41.60 bushels.
Chaff, &c. ..	370	2.14 tons	528	1.66 tons.
Maize—				
Grain	8,508	49.75 bushels	10,249	47.94 bushels.
Ensilage	557	3.01 tons	730	3.31 tons.
Peas and beans ..	11,749	24.48 bushels	15,495	29.35 bushels.
Linseed—Seed ..	8,143	0.29 ton	4,933	0.39 ton.
Rye-grass—Seed ..	45,154	456.77 lb.	42,082	424.45 lb.
Cocksfoot—Seed ..	9,745	173.90 lb.	9,820	189.21 lb.
Chewings fescue—Seed	6,902	228.12 lb.	9,634	225.98 lb.
Crested dogstail—Seed	2,679	174.96 lb.	9,307	159.26 lb.
Red clover and cow-grass—Seed	6,579	185.16 lb.	8,540	181.87 lb.
White clover—Seed ..	5,358	176.13 lb.	4,029	165.07 lb.
Other grasses and clovers—Seed	3,132	153.55 lb.	4,287	87.57 lb.
Grasses and clovers cut for hay	224,777	1.76 tons	288,455	1.90 tons.
Potatoes	23,484	6.09 tons	24,616	4.73 tons.
Green fodder crops ..	255,429	..	219,031	..
Turnips	468,475	..	462,360	..
Mangolds	13,296	..	11,870	..
Onions	514	8.73 tons	765	9.28 tons.
Hops	648	1,159.59 lb.	636	1,408.14 lb.

Correction.—In the statement of fertilizer importations printed on page 351 of last month's *Journal* the amount of sulphate of ammonia imported from the United Kingdom should have been 1 ton.

LIVE-STOCK IN NEW ZEALAND, 1927.

Unless otherwise specified, the enumeration is at 31st January.

Land District.	Horses.	Asses and Mules.	Cattle (including Dairy Cows).	Dairy Cows.		Number of Sheep shorn, 1926-27.	Number of Lambs tailed, 1926-27.	Sheep (including Lambs) as at 30th April, 1927.	Pigs.	Goats.	
				In Milk.	Dry.					Angora.	Other.
North Auckland	33,725	71	405,127	184,027	24,635	856,563	377,119	852,960	78,139	946	2,705
Auckland	44,862	2	716,077	321,022	22,505	1,103,057	560,639	1,049,451	158,984	1,017	3,266
Gisborne	18,349	38	274,516	26,161	5,986	2,893,188	1,237,714	3,071,806	12,771	633	2,209
Hawke's Bay	15,319	1	201,423	43,137	8,063	2,734,083	1,301,983	2,899,481	16,743	1,132	2,081
Taranaki	20,181	5	356,120	192,765	10,120	824,352	392,784	785,166	63,569	72	5,200
Wellington	40,487	31	637,750	178,451	19,893	5,094,919	2,589,536	5,389,895	75,586	708	763
Nelson	6,837	5	63,443	24,417	3,718	369,090	147,197	421,662	14,773	752	662
Marlborough	6,830	5	44,454	14,610	1,894	994,091	422,624	1,070,509	7,051	267	3,099
Westland	2,238	..	40,370	10,384	2,200	57,364	39,442	63,374	5,978	21	135
Canterbury	57,010	41	174,614	70,966	9,133	4,154,837	2,635,526	4,825,575	51,230	255	130
Otago	32,740	16	125,195	49,127	6,936	2,825,274	1,404,366	3,361,551	21,260	7	25
Southland	25,135	7	158,640	66,478	6,597	1,534,990	960,751	1,857,586	14,059	6	8
Dominion totals	303,713	222	3,257,729	1,181,545	121,680	23,441,808	12,069,681	25,649,016	520,143	5,816	20,283
Totals 1926 (or 1925-26)	314,867	161	3,452,486	1,181,441	122,415	22,686,200	11,435,780	24,904,993	472,534	4,945	16,816

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